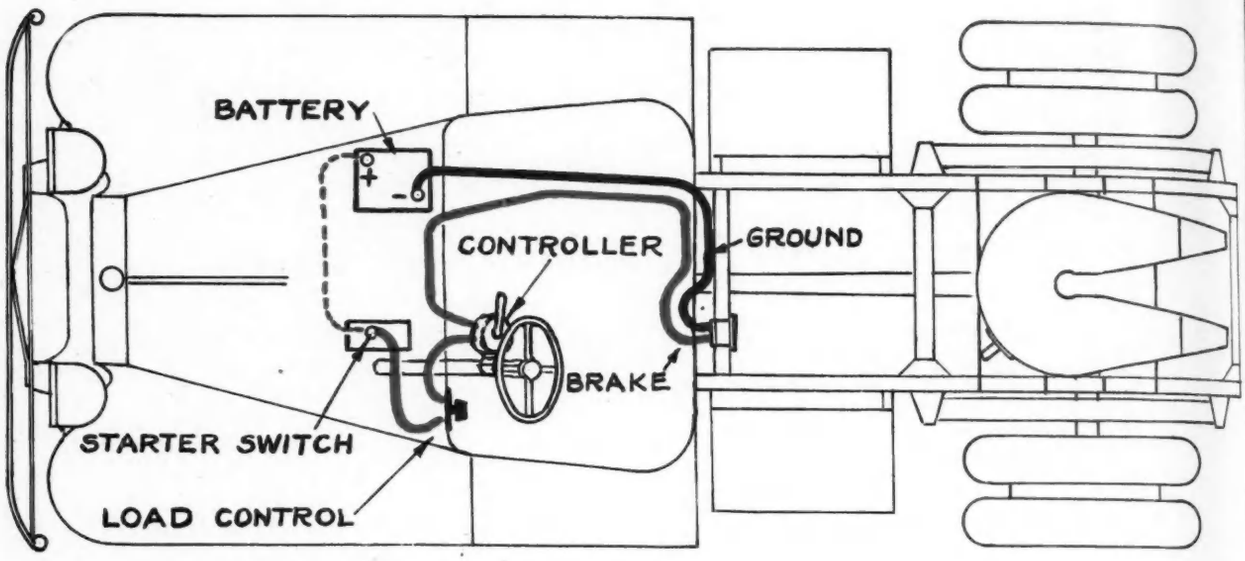
AUTOMOTIVE INDUSTRIES

LAND — AIR — WATER

JUNE 26, 1937

The Only TRAILER BRAKE That Does

CHASSIS DESIGN - - TRACTOR



Wiring Diagram for Tractor, showing Rheostat Controller clamped to steering post, connected by wire to storage battery, and connecting with trailer's braking system by rubber-covered cable which also contains wiring for running lights, stop-lights and tail-lights.

The power of an electric brake is obtained from the tractor's storage battery and applied to electro magnets in the brake drums—using about as much current as a tail-light consumes. The electric brake is a power brake in itself and not a mechanical brake operated by outside power units.

The driver's control for the Warner Electric Brake is a rheostat clamped to the steering post. A rubber-covered cable connects to the trailer — also carrying wiring for stop-lights, running lights and tail-lights. This cable plugs in to a pull-away socket on the trailer. A sturdy wire carries current to each brake, thereby eliminating 65% of the accessories now required on other types of braking systems.

Practically the entire electric braking system is installed on the trailer by the trailer manufacturer, simplifying connection with the tractor and transfer from one tractor to another. *Stopping Power* of the Electric Brake is applied evenly and instantly to any desired amount regardless of the length of the trailer. The Electric Brake is now being used by such organizations as the Pure Oil Co., all subsidiaries of the American Telephone & Telegraph Co., Curtis Publishing Co., Commonwealth Southern Corp., Penn. Power & Light Co., Standard Oil Co. of Ohio, the United States Army and many others.

WARNER ELECTRIC BRAKE MFG. CO.

Beloit, Wisconsin

The Only POWER BRAKE Designed

Expressly for TRAILERS

AUTOMOTIVE INDUSTRIES
THE AUTOMOBILE

Reg. U. S. Pat. Off.
Published Weekly

Volume 76 Number 26

Contents

C. A. MUSSELMAN, Pres.; J. S. HILDRETH, Vice-Pres. and Manager, Automotive Division; G. C. BUZBY, Vice-Pres.

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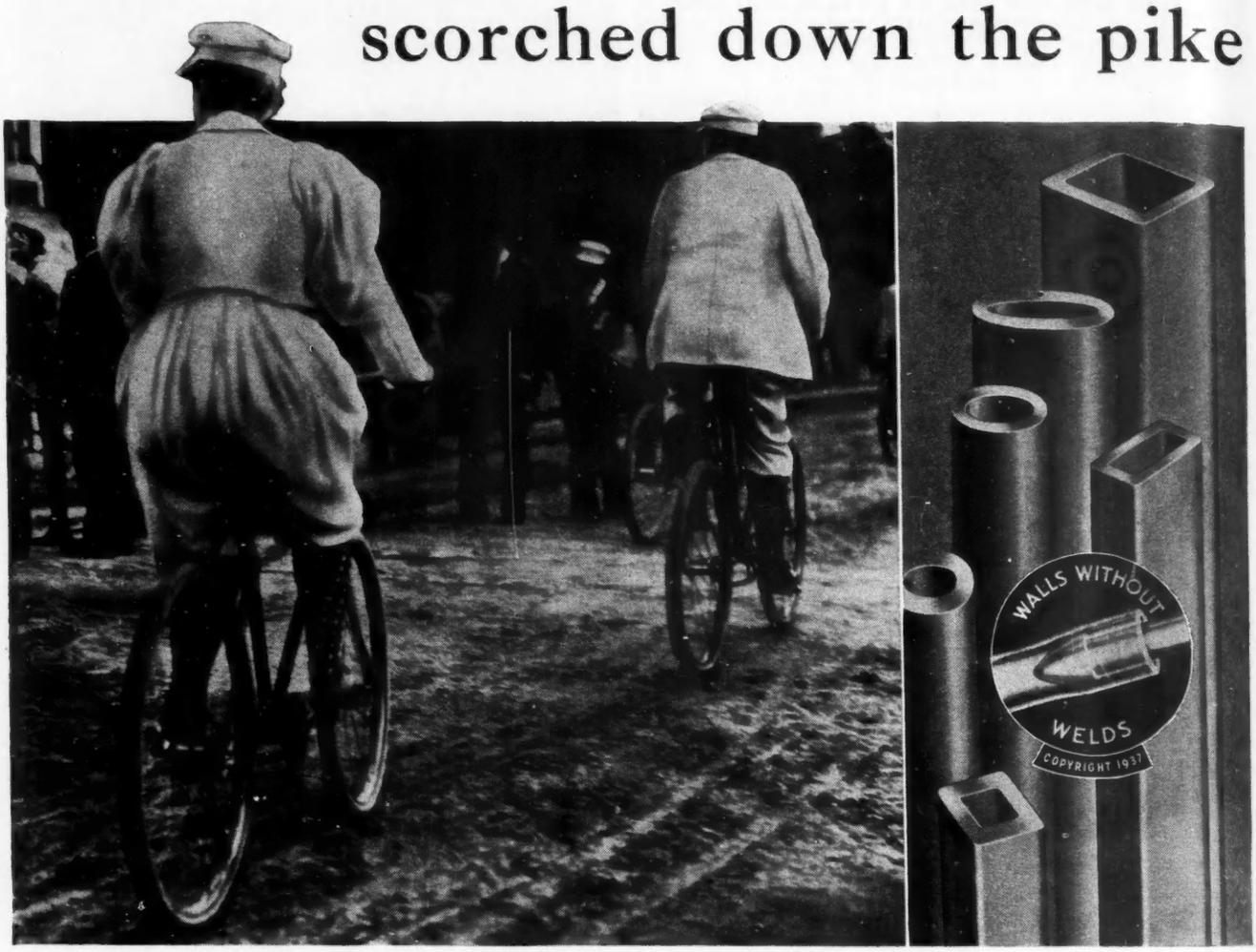
Since "safety bikes" scorched down the pike



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Published Weekly
Founded 1895

AUTOMOTIVE INDUSTRIES

June 26, 1937
Vol. 76, No. 26

Federal Court Outlaws Sit Down Strike

A sitdown strike at the Philadelphia plant of the Apex Hosiery Co. was described on June 21 as "unlawful and criminal" by the Federal Circuit Court of Appeals for the district. The court ordered the strikers to vacate the property and restore it to the owner.

Principle of the decision was widely regarded as basic. The union was declared by the court to be a violator of the Sherman Act. It was also criticized for failing to take advantage of the Wagner Act. Counsel for the union said the case would be appealed to the Supreme Court. It was the first Federal court ruling on such strikes apart from temporary injunction proceedings.

June Output Behind Schedules

Several Manufacturers 20 Per Cent Under Planned Production; Large Retail Demand Prevents Additions to Field Stocks

As in most other months this year, June production of the automobile industry will fail to attain the volume indicated by factory schedules because of labor troubles. Several of the leading companies which had projected substantially higher output this month than they built in May have run behind as much as 20 per cent. Some of this loss can be made up during the balance of the month if there are no further interruptions, but as it looks now the total for the industry will be shy of the May figure by about 15,000 units despite the fact that the current month has two more working days than May.

With reasonably smooth going from now on, the industry should finish June with an output of around 515,000 cars and trucks, compared with an estimated 530,000 units in May and 469,355 in June, 1936. Thus the indicated output for the first half of 1937 is 2,900,000 vehicles, of which the second quarter accounts for some 1,598,000 units, against 1,301,681 in the first quarter. The increase over the first half of 1936 is just under 12 per cent. The second quarter's gain over a year ago dropped to less than 9 per cent from over 15 per cent shown by the first quarter.

Retail sales in the domestic market have been holding a good lead, over corresponding months of last year. Up to the end of May, deliveries were 11.2 per cent ahead of the similar five-month period of 1936. The first returns for June indicated that the current month would run about on a par with May deliveries of 474,000 cars and trucks, making a relatively better showing that June last year when deliveries dropped some 18,000 units below the preceding month's volume.

Current factory output continues to flow promptly into consumers' hands with the result that field stocks remain about the same. At the end of May, passenger car stocks in the country were equivalent to a three weeks' supply, little changed from the April 30 level, and just 15 per cent below the passenger car inventory a year ago.

Used car stocks, on the other hand, are estimated to be 16 per cent higher than they were a year ago, varying considerably between companies. But used cars have been moving relatively faster than the new. According to one authority, country-wide sales of used

(Turn to page 932, please)

Public Expects Car Price Rise

Man on the Street Responds to AUTOMOTIVE INDUSTRIES' *Query With Guess of at Least $40 More for 1938 Models*

Almost every "average man" questioned on the streets of representative cities during the past week by a dozen AUTOMOTIVE INDUSTRIES' reporters is convinced that prices will be higher on the 1938 models to be announced in the fall.

The public appears to expect price increases of at least $40 on the lower-priced cars, of $50 or more on the medium-priced group, and of $100 and up on the more expensive makes. The figure of 10 per cent, expressed by many on the streets, is too high in the lower brackets if the dollar increases work out as expected.

The consensus of opinion indicated the view that it will not be "unfair" or "outrageous" for the automobile companies to raise prices moderately. Reaction on sales will depend largely upon the astuteness with which manufacturers gage the price advances, said the average man. Those who want new cars more than casually will not be stopped by price increases.

Leading reason given for the expected higher prices is the rising cost of labor and materials, with labor cost cited more often as the primary factor. Strike-caused sales losses were also given weight. In New England, the opinion was expressed by some that car prices should not go up. Manufacturers' profits have been substantial and the public should have the benefit—in fact, should have had it this year.

A number of persons queried said they thought that at least part of the increase in car prices would be offset by higher trade-in allowances from dealers.

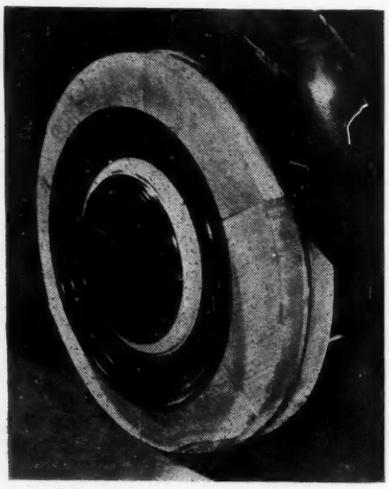
Following is the result of the survey by city or district:

(Turn to page 928, please)

This Week

NEWS includes the forecast of the man on the street that car prices will be higher this fall . . . Late labor front developments . . . A report that production is falling behind June manufacturing schedules . . . Dispatch reporting that the Motor Vehicle Society in Southern California is preparing young men for SAE membership.

FEATURES include a detailed report on a new Japanese export vehicle, the Sanrinsha . . . An analysis of turbo torque converters by Bendix's Joseph Jandasek . . . Description of the Stromberg Aerotype Carburetor . . . A paper on the design of cooling systems.



SHOES of wood, installed for much the same reason as Dutch children wear them, economy and protection. Here they are shown on a Pontiac intended for export. Foreign made tires will be put on when the car arrives.

UAW Resumes Its Ford Campaign

Distributes "Ford Edition" of Paper and Plans Drive at Plant July 7; Probes Wild Cat Strikes; Situation Quieter

The campaign of the United Automobile Workers to win Ford Motor Co. employes was resumed in Detroit June 23 with a new distribution of literature, in the form of a "Ford edition" of the union's publication, *The United Automobile Worker*, just outside Dearborn. Two patrolmen ordered the organizers back when they stepped across from Detroit to Dearborn. It took place about a mile from the Ford plant where union organizers were driven off in a street riot on May 26. Some workers refused to accept the papers.

The union states that another and better organized move to distribute its material will take place at the Ford plant gates on July 7. The Ford edition will be issued each Wednesday.

A strike of 3500 Motor Products Corp. employes, described as an outlaw strike, was settled June 23. It broke out early this week only three days after the general executive board of the UAW voted to impose strict disciplinary measures on "wild cat strikers." The strike arose over a dispute on truck drivers work schedules.

A two-day strike at the plant of the Zenith Carburetor Co. ended June 23 with a wage increase still an open question. Five cents an hour more was granted, at the request of the Mechanics Educational Society, but 10 cents an hour was asked by UAW workers.

The UAW is attempting to establish a standard wage scale for all moulding plants supplying automotive plants in an effort to "remove wages from competition." A conference is sought for Aug. 2. The union threatens action against plants which do not meet the finally negotiated wage scale.

The union is taking steps to prevent

Wage Bill Losing Support

The chances for passage of the Black-Connery wage-hour bill at this session of Congress are said to be decreasing daily. Observers who, a week or two ago considered its passage "inevitable," now concede that the measure has only a 50-50 chance at best and that a definite trend against the measure is growing in momentum.

Growing resentment against the Administration's tactics, particularly the increasingly intense White House pressure, is cited as partially responsible for this trend. Also indicative of the present feeling is the departure of Vice-President Garner from Washington and the apparently increasing reluctance of Senate Majority Leader Robinson to go all the way down the line with Administration forces as has been his unfailing custom in the past.

Car Field Stock Trend Changes

NADA Analysis of Dealer Reports Shows First Year-end Drop in Inventories of New Vehicles; Used Car Holdings Climb

Striking changes in dealer inventories of new and used cars and trucks have occurred, an analysis of the trend for several years by the National Automobile Dealers Association shows. For the first time in 1936, according to the association, dealers had on hand at the close of a year fewer new cars and trucks than at the beginning of the period, while used vehicle stocks were rising.

New car stocks on hand on Jan. 1, 1936, averaged 16.3 per dealer, while on Dec. 31, 1936, the figure dropped to 12.4 for each of the 1075 dealers reporting. Used car stocks on Jan. 1, 1936, rose from 30.4 per dealer to 35.5 per dealer on Dec. 31, 1936.

For 1935, new vehicle inventory on Jan. 1 averaged 9 for each of the 1327 dealers reporting, and rose to 19.3 on Dec. 31. Used vehicle inventory stood at 24.9 on Jan. 1 and rose to 37.1 on Dec. 31.

In 1934, the last year before the introduction of the fall showings, new car stocks averaged only 3.5 per dealer on Jan. 1 for the 1370 reporting, and rose to 5.6 on Dec. 31. Used vehicle stocks averaged 14 per dealer on Jan. 1 and rose to 18.1 on Dec. 31.

Probable reason for the rise in new car stocks late in 1935 was the first of the fall automobile shows. Smaller stocks per dealer at the end of 1936 would reflect the success of the fall show policy, the public taking more cars than it did the first year of the experiment. It doubtless also reflected some production troubles, with dealers unable to secure all the new models they wanted. And it may also have shown the effect upon dealer operations of the tying up of capital in used cars.

Truck reports alone, made by 572 dealers for 1936, showed the effects of improving general business in a sharper decline in new truck inventories and a smaller increase in used truck inventories than was shown for passenger cars. In other words, trucks were in demand, as has been shown subsequently in record sales.

The association remarked that the instalment sales figures shown were incomplete for the reporting dealers, since some transactions were financed through banks and appeared in the tabulations only as cash sales.

Figures and dealer operations are:

	1936*	1935*	1934*
No. of dealers rptg.	1,075	1,327	1,370
New cars sold at retail	201,420	249,592	143,843
New cars sold on install.	122,613	144,736	73,204
Used cars sold at retail	330,603	393,780	230,223
Used cars sold on install.	193,255	246,525	133,393
Used cars junked	36,747	38,236	17,527
Used cars traded on new sales	170,629	211,600	107,490
Used cars traded on used sales	168,330	216,713	108,882
Total used cars bought	338,959	428,313	216,372
Avg. N. C. sales per dealer	187	188	105
Avg. U. C. sales per dealer	308	297	168
Avg. used cars bought per dealer	314	323	157.9
Percentage Sold on Installments:			
New cars	60.9	58.0	54.4
Used cars	58.5	62.6	58.0
All cars	59.3	60.8	56.8
Percentage of Trade-Ins and Used Car Sales:			
Trade-ins on sales of new cars	84.7	84.8	74.7
Trade-ins on sales of used cars	50.9	55.0	47.3
Total trade-ins in per cent of new cars sold	168.3	171.6	150.4
Used cars sold in per cent of new cars sold	186.3	173.1	172.2
Used cars junked in per cent of total trade-ins	10.8	8.9	8.1
Inventories:			
New cars on hand 1/1	17,612	12,015	4,813
New cars on hand 12/31	13,325	25,621	7,758
Used cars on hand 1/1	32,717	33,161	19,223
Used cars on hand 12/31	33,244	49,315	24,805
Per cent change N. C. inventory	—24.34	+113.24	+61.19
Per cent change U. C. inventory	+16.89	+48.71	+29.04

*Calendar year.

the outbreak of any more unauthorized strikes. In addition to the orders for discipline, John Brophy, a director of the CIO, is sitting with a UAW committee which is conducting a secret inquiry. Under probe is the Saginaw power strike which left thousands lightless when employes of the Consumers Power Co. refused to accept a wage agreement and turned off the power.

One of the reasons for the probe is a protest by William S. Knudsen, General Motors president, that over 200 unauthorized strikes have crippled 48 General Motors plants since an agreement was signed with the UAW on March 12.

Francis J. Dillon, American Federation of Labor organizer, remarked of the Knudsen statement that it confirmed his own expectations of what would happen. He charged the CIO with "the apparent destruction of practical and constructive collective bargaining in the General Motors Corp." Dillon hinted that another effort may be made at the UAW convention in Milwaukee on Aug. 23 to bring the group back into the A.F. of L.

The Diamond T Motor Car Co. has signed an agreement covering wages, hours and working conditions with the Automotive Workers Industrial Union.

A five-week strike at the plant of the Norma-Hoffman Bearings Corp. was settled June 22 with a CIO agreement.

General Motors-UAW negotiations on a new contract, to have begun June 22, were postponed.

The Cope-Swift Foundry Co. of Detroit, has closed indefinitely because of union activity.

International Photo

ROSEMEYER, 1936 Grand Prix winner in Europe, who is bringing a German rear engined Auto Union car here for the Vanderbilt Cup Race at Roosevelt Raceway on Long Island. The race is to be held July 3 on a track which has been rebuilt for greater speed than was reached in the first race there last fall.

Frank Rice

Frank Rice assistant manager of the Ford Motor Co. branch at Des Moines, Ia., drowned when his canoe upset in the river near Adel, Ia. He was 46.

Foreign Cars in Vanderbilt Race

German Teams on Way With Auto Union and Mercedes; Italians to Compete Again on Faster Long Island Raceway Track

Foreign racing cars and drivers, several of them champions, will compete with leading Americans in the Vanderbilt Cup Race at Roosevelt Raceway, Mineola, L. I., N. Y., on July 3. A group of four racing cars from Germany, two Auto Union and two Mercedes, is scheduled to arrive June 28, and it is expected that the Italian team of Nuvolari and Trossi will again be present. Nuvolari won the first race on the track last fall. A South American delegation is due June 30. It will enter a German Auto Union car.

The track has been remodeled for the race. Nine curves of the 16 and two-thirds of a mile have been cut from the layout in an effort to raise the speed of the race. Last fall, the winning time was only 65.996 m.p.h., but in tests recently, Rex Mays, Los Angeles, driving an Alfa Romeo, reached 80 m.p.h. for a circuit of the 3 1/3 mile track. In addition, there is a sharply banked curve where the track turns into the main straightaway in front of the stands which is expected will permit very high stretch speeds.

One of the leading foreign drivers entered is Bernd Rosemeyer, Germany, 1936 Grand Prix winner in Europe. He and Von Delius will drive the Auto Union cars. Richard Seaman and Rudolf Caracciola will drive the Mercedes. The Italian drivers will use 12 cylinder Alfa Romeos, 1936 models.

Although constituting the greatest novelty, the Auto Union rear engine racers are not new. Designed by Engineer Porsche, they went through two years of teething troubles; last year they carried all before them, and this year the only modifications are in brake details. Last year the Vanderbilt limit of 6 litres kept the Auto Unions out of the race on Roosevelt Raceway, for the displacement of the cars is 6008 cc. (366.5 cu. in.). They have sixteen cylinders of 75 by 85 mm. (2.95 by 3.34 in.) bore and stroke.

Aviation practice is followed in the design of the Auto Union cars. The 16 cylinders are a single light alloy casting with liners. There are three camshaft housings, the central housing containing the camshafts for two banks of cylinders. The vertical Roots type blower is at the rear of the engine and sucks through two carburetors. There are two Bosch magnetos, mounted transversely at the rear of the engine, each one serving a bank of eight cylinders. Oil and water radiators are in the usual position in front, while the gasoline tank is between the driver and the engine. Body and chassis are one unit, and water and oil are led to the engine through the body members. Independent torsion bar suspension is used throughout. Brakes are hydraulically operated. Engine, clutch and transmission are within the wheelbase. Although cars of this design have now been racing for three years, they never have been uncovered in public and few details of their construction have been allowed to leak out. They come within the weight limit of 1750 lb. and develop 550 hp.

Piston displacement of the Mercedes cars has been increased to nearly 6 litres (366 cu. in.), but the general design of the engine remains unchanged from 1936 practice. Steel cylinders, with sheet steel jackets are mounted on a magnesium crankcase. There are two overhead camshafts and four valves per cylinder. A vertical Roots type blower is mounted in front and blows into two carburetors.

The greatest changes are in the chassis, which are of the central tube type, with independent suspension all round, the front end having wishbones and coil springs, and the rear having torsion bars. There is separate control for each steering wheel; clutch is single dry plate, there are four speeds and reverse, and brakes are applied hydraulically. In accordance with international regulations, the weight of the complete car does not exceed 1750 lb. Structural details have been kept secret and little opportunity has been afforded of examining the cars in detail. The power output is known to be between 500 and 550 hp., and Tripoli and Berlin races showed that the cars had a maximum speed in excess of 200 m.p.h.

Motor Vehicle Society Growing

Membership in Young Southern California Group Termed "Stepping Stone" to Broader Activity in the SAE

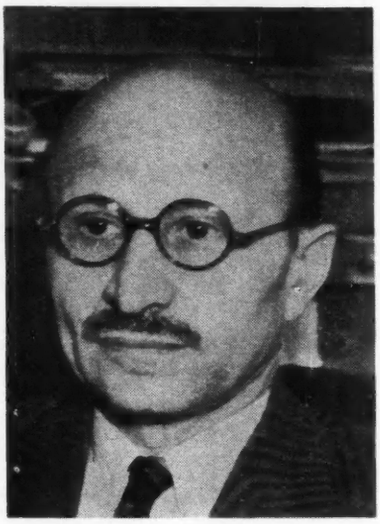
Over two hundred young men whose interests lie in automotive engineering now form the membership of the Motor Vehicle Society, an organization described by its founder, Ethelbert Favary, consulting engineer of Los Angeles, as a "stepping stone" to the Society of Automotive Engineers. The society was formed five years ago and has produced many of the officers of the Southern California section of the SAE.

Mr. Favary, Hungarian by birth, has for years taught automotive engineering at the Frank Wiggins Trade School at Los Angeles. More recently, he has also taught Diesel engine construction. He was at one time on the governing board of the Metropolitan section of the SAE. Many prominent automotive engineers were enrolled under him.

The Motor Vehicle Society sprang simply from the need for some form of organization which would enable Mr. Favary's students to maintain contact, both social and professional, with automotive engineers until such time as their qualifications enabled them to join the SAE. The society offers its members and guests lectures and demonstrations, bringing SAE members to the meetings as speakers, and also offers social opportunities. Mr. Favary hopes to see other associations of the sort spring up throughout the country.

Meetings are held monthly and include dinner and the reading of papers, and, if possible, demonstrations.

In regard to the type of papers read, Mr. Favary says: "It is our aim to give the men more papers of a practical nature and to encourage discussions following each reading. This policy promotes a clearer understanding of the points brought up by the speakers and allows talent to make itself known.



FAVARY, founder of the Motor Vehicle Society, which he describes as a "stepping stone" to SAE membership.

"Members who show marked ability both in automotive engineering and in organization work are selected as officers."

The following members of the SAE were at one time officers of the Motor Vehicle Society: Larry Grunder, present chairman of the Southern California section of the SAE; Robert Reinhardt, 1935-36 chairman of the Southern California section; and W. E. Powelson, present vice-chairman of the Southern California section.

A large proportion of the attendance at every meeting is made up of guests. The meetings are open to anyone interested in automotive engineering.

U. S. New Car Registrations and Estimated Dollar Volume by Retail Price Classes*

	New Registrations				Estimated Dollar Volume			
	April		First Four Months					
	Units	Per Cent of Total	Units	Per Cent of Total	April	Per Cent of Total	First Four Months	Per Cent of Total
Chevrolet, Ford and Plymouth	225,876	58.64	737,451	59.29	$156,100,000	51.13	$510,300,000	51.99
Others under $750	5,924	1.54	17,157	1.38	3,350,000	1.10	9,750,000	.99
$750-$1000	130,757	33.94	419,534	33.73	115,000,000	37.67	366,200,000	37.31
$1001-$1500	19,631	5.10	59,955	4.82	23,700,000	7.76	72,200,000	7.36
$1501-$2000	1,378	.36	4,551	.37	2,400,000	.79	7,800,000	.79
$2001-$3000	1,316	.34	4,119	.33	3,500,000	1.14	10,900,000	1.11
$3001 and over	305	.08	1,081	.08	1,250,000	.41	4,350,000	.45
Total	385,187	100.00	1,243,848	100.00	$305,300,000	100.00	$981,500,000	100.00
Miscellaneous	90		674					
	385,277		1,244,522					

* All calculations are based on delivered price at Factory of the five-passenger, four door sedan, in conjunction with actual new car registrations of each model. The total dollar volumes are then consolidated by price classes. No comparative data with a year ago are available due to the change in the listing of the prices from the old F.O.B. which did not include certain standard equipment, to the new delivered prices which include standard equipment, Federal taxes but no transportation charges.

Gasoline Tax Largest

20th Century Fund Says It Is 7 P.C. of Revenues

The gasoline tax is the largest tax imposed in the United States on a single article, the Twentieth Century Fund reports in a survey of taxation in the United States. It produces 7 per cent of all federal, state, and local revenues —3 per cent of federal and 9 per cent of state and local revenues.

No state failed to spend more on construction and maintenance of its roads than it received in gasoline taxes in 1929, the fund's research staff notes. The Federal revenue from the gasoline tax alone was 75 per cent of total Federal grants-in-aid for highway work in 1933, 90 per cent in 1934, and 58 per cent in 1935. Total automotive tax revenues, however—including manufacturers' excises on oil, tires, tubes, automobile bodies and accessories—were 105 per cent of Federal aid expenditures in 1933, 133 per cent in 1934, and 96 per cent in 1935.

The Federal government's excise taxes on chassis, lubricants, tires, tubes and accessories were imposed on the theory that they were luxuries or semi-luxuries, the Twentieth Century Fund's report points out. It finds little justification for using them as "benefit taxes," since their use does not correspond very closely to the wear and tear on highways. Because it is difficult to determine the degree of wear and tear caused by different types of vehicles, the fund's research staff suggests that a study should be made to determine whether existing gasoline and motor vehicle tax rates distribute the burden equitably among the various groups of road users.

Motor vehicle rates range from $3 to $15 for most owners of pleasure cars. The tax is paid by from half to two-thirds of the 30,000,000 families in the country—the largest number of people paying any single tax directly to the government.

Auto Finance to Add Shares

The Automobile Finance Company has notified stockholders of a special meeting to be held on Aug. 10, 1937 for the purpose of acting on a resolution increasing the capital stock from $1,000,000 of 7 per cent preferred to $2,000,000 and authorizing $1,000,000 of new 6 per cent preferred equal in all respects to the 7 per cent preferred insofar as preference is concerned both as to assets and dividends, and carrying the additional privilege of conversion into common stock. It is also proposed that the common stock be increased from 500,000 to 750,000 shares and that it be changed from a no par value to a par value of $1.00 for listing on the New York Curb Market.

Soviet Diesel Output Forced

Factories Change Over to Tractor and Engine Production Despite Poor Organization; New Research to Begin

The importance of Diesel engines in tractors, aircraft, etc., is gaining recognition in the Soviet Union. The Cheliabinsk Tractor Plant, for instance, which has manufactured more than 69,200 machines, produced the last "caterpillar" tractor of the old type on April 1, since which date it has concentrated on Diesel-powered units. Cheliabinsk was to turn out 200 tractors with Diesel engines in May, and 12,000 by the end of 1937. Working on heavy fuels, the new tractors are hailed as very economical. The various shops at Cheliabinsk are now busy manufacturing parts for the Diesel-equipped machines.

At Kolomna, the Kuybishev Machine-Building Works is expected to produce by the end of the year various stationary and ship Diesels aggregating 188,000 horsepower. Depending on other organizations to provide it with important parts, operations are often interrupted by the failure of co-operating enterprises to maintain a steady flow of supplies, with the result that scores of almost-completed Diesel engines accumulate on the premises every now and then. Particularly delinquent has been the Krasnoye Sormovo Factory which is responsible for finished and semi-finished shafts. For months the Kuybishev Works has been promised 6-cylinder crankshafts. Another organization, the Uralmashzavod, refused to sign a contract for the production of eight crankshafts on the ground that it had a busy schedule of its own.

In a recent article appearing in the *Za Industrializatziyu*, the daily organ of the Commissariat of Heavy Industry, all these delinquencies are sharply criticized, which in the U.S.S.R., foreshadows a sharp turn for the better. The article declares that "Diesel production is a most important task of our heavy industry. The Commissariat will henceforth watch daily the progress of the Diesel program."

Recent criticism from other sources may also be considered a prelude to improvements in a near future. In the *Leningradskaya Pravda*, L. P. Erukhimovich writes: "Our Diesel construction is acutely below the general level of the Soviet machine-building. The Diesel-producing plants are basically working on heavy machines of the 1929-1931 vintage. Their program is virtually devoid of Diesels of original Soviet design. Up to now they have been engaging in a simple copying of foreign machines, most of them antiquated.

"If we compare the Diesels from our factories with those from the leading concerns abroad, we get a picture none too flattering to us.

"Speedy Diesels of 700-1200 r.p.m. constitute standard goods abroad; their weight per 1 hp. does not on the average exceed 20-25 kilograms for the stationary and 10-15 kilograms for moving varieties. At the same time our plants are turning out Diesel engines of 180-300 r.p.m. Their weight is two to five times greater than that of the foreign ones. This leads to a tremendous waste of metal, not to mention how unsuitable for use the heavy Diesels are. Besides, the quality is not high. Nor are the country's needs satisfied in regard to quantity. The Second Fve-Year Plan in respect to Diesels is unfulfilled. We are very backward in this. It will suffice to say that in 1936 the United States manufactured seven times as many Diesel engines as we did.

"We have assimilated the production of mighty steam-turbines, high-pressure boilers, most complex lathes, artificial rubber, etc. We can no longer reconcile ourselves to our backwardness in so important a field. During the Third Five-Year Plan our Diesel construction must rise to the level of the latest technique. The nation needs fast Diesels of the light type. Their quality must be raised sharply."

The reference to the Third Five-Year Plan recalls one of its most important assignments—to provide the Soviet commercial shipbuilding industry with Diesel engines of contemporary designs. The *Russky Dizel* (Russian Diesel) Plant is charged with this responsibility.

The new plan is also expected to solve the problem of producing sufficient fuel apparatus for high speed Diesels, now largely imported.

Experts in the Soviet Union are agreed that one of the principal reasons for the retardation of Diesel development is the failure to appreciate the need of scientific research and design experimentation in this field.

It is now anticipated that before long a powerful research institute will be set up, to work on the problems of designing new motors and organizing large-scale production.

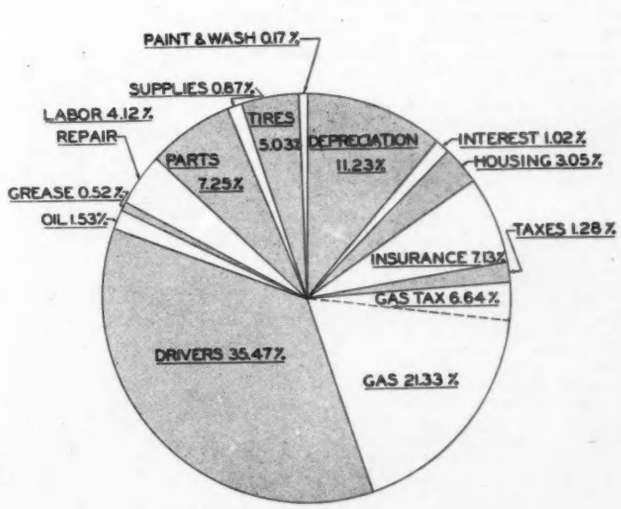
Tire Heat Dissipator Used

Cushion shoulder, a new development in truck tire construction which dissipates heat and lengthens tire life, is announced by U. S. Tire Dealers Mutual Corp. It consists of a section of special compound, cool-running stock built into the truck tire tread, deep in the shoulder below the point of smooth tread wear. This new construction feature is said to generate less heat in the shoulder area, which is the high heat area, and it dissipates heat generated by the constant flexing of the cord body.

In commenting on cushion shoulder, H. G. Noss, manager of the United States Rubber Co. truck tire department, said:

"Truck tires, especially in heavy-load, high-speed operation, build up excessively high temperatures. Readings as high as 365 degrees have been found under tread shoulders. Temperatures as high as 290 to 300 degrees are common. When you recall that water boils at 212 degrees, you appreciate just how hot truck tires become in operation."

Cushion shoulder construction is now standard in all sizes of U. S. Royal Fleet Delivery, and in a number of sizes in U. S. Royal Fleetway and U. S. Royal Rayon Cord truck tires.



TRUCK COSTS

are clearly shown in this analysis by the Autocar Co. Initial cost is reflected in depreciation and interest, and is smaller in proportion to the total than many have believed. Total labor cost is the major factor.

Public Sees Prices Up

(Continued from page 923)

Milwaukee—Virtually all persons interviewed believe that higher automobile prices are inevitable due to increased labor costs in all contributing fields. Guesses ranged up to 10 per cent. Several persons said that because automobiles are now advertised without prices, few prospective buyers will be able to estimate the amount of the increases. Many said a small increase in price would not prevent them from buying if they wanted to buy and had the funds. Several expected larger dealer allowances.

Wilmington, Del.—There was not a single instance of a person failing to admit instantly that prices will be higher for 1938 models. People felt that moderate priced cars would rise between $40 and $60, and that the higher priced cars will advance from $80 to $100. Most of those queried are not "crazy" about paying more for cars, but said that if the increases are not too broad, "perhaps it will be worth it." No one felt it "outrageous" that there should be an increase.

Huntington, Ind.—Every man asked expects new car prices to rise. Business men, farmers and workmen were interviewed. Average expectancy is for increases of 10 to 15 per cent. The man on the street will prefer to pay more for a new car than to buy a good used car. People all expect to pay from $50 to $75 more next fall. The upswing in the price of almost all consumer products was given as the reason. Labor cost increases were said to be the underlying factor.

St. Louis—Prices will be higher, car manufacturers using higher labor costs as the "excuse." People willing to pay more because they expect more for their used cars.

Baltimore—Without exception, those interviewed expect higher automobile prices, due to plant strikes this year. Highest estimate of the increase was 10 per cent, with most persons guessing 6 or 8 per cent. No one would refuse to buy a needed new car because of a price increase but many would try to make the old one do another year.

Birmingham, Ala.—The man on the street thinks new car prices will go up 5 per cent or more this fall, because, "everything else is going up," "the manufacturers lost money during the strikes," "labor is higher," and "steel costs more." Opinion summarized in the comment "I expect car prices to go up but I hope they don't." Some persons said they thought small car prices would rise $50 to $90.

Boston—Majority believe 1938 models will be priced higher, but do not feel the advances will be very large. The average man feels competition will hold the increases to a "fair margin." "There are some who believe car prices should not go up. These persons say that manufacturers have made a great deal of money and should have passed on the benefits this year. They also cite the high cost of financing by comparison with low bank and government bond interest rates.

South Bend, Ind.—With but few exceptions the man on the street believes that 1938 cars will sell for anywhere from 5 to 20 per cent higher than the present prices. New cars will be purchased even at the higher prices by some and others will not buy new cars and cheaper cars will replace the higher priced classes if prices go up. It is almost invariably the belief that labor and the rise in prices of materials would be the determining cause of price increases. Taxes and social security were in some cases added to the labor and material costs. The belief was also expressed that manufacturers would raise the prices of new cars to whatever point they felt the traffic would stand.

Bus Dividends Financed

Forced to pay dividends to avoid surtaxes on undistributed profits, three affiliates of the Greyhound Corp. have applied to the Interstate Commerce Commission for authority to issue additional shares of stock which will be sold to stockholders. In most of the cases the parent company is the stockholder. The proceeds will be applied to the liquidation of equipment loans which were made when the surtax law resulted in use of cash for dividend payments. The three companies which will issue stock are the Capitol Greyhound Lines, Pennsylvania Greyhound Lines and Southwestern Greyhound Lines.

Three of the Greyhound companies have applied for the authorization of loans from the National City Bank of New York aggregating $1,068,000 for the purpose of buying 89 coaches from the Yellow Truck and Coach Mfg. Co. The loans will cover 90 per cent of the cost of the buses. The companies are the Atlantic Greyhound Corp., Central Greyhound Lines and the Greyhound Corp. itself.

Dividends Declared

American Coach & Body	25¢	June 21	July 1
Coleman Lamp .	25¢	June 30	July 15
Consolidated Aircraft	q 75¢ cvpr	June 19	June 30
Divco-Twin Truck	q 10¢	June 25	July 6
Doehler Die Casting	50¢	July 10	July 26
Fedders Mfg. ..	25¢	June 23	July 1
Fifth Ave Coach	50¢	June 15	July 1
Firestone Tire & Rubber	50¢	July 2	July 20
Gemmer Mfg. ..	$3 cum. part. pr A	June 21	July 1
Hill Diesel	q 1¢	June 7	July 1
Mallory, P. R. ..	q 25¢ (new)	June 24	June 29
Mallory, P. R. ..	100% (stock)	June 21	....
McQuay-Norris	q 75¢	June 22	July 1
Noblitt-Sparks .	q 50¢	June 21	June 30
Shaler Co.	q 50¢ A	June 20	July 1
Shaler Co.	q 15¢ B	June 20	July 1
Spicer Mfg.	q 75¢ pr	July 2	July 15

Lars Rand

Lars Rand, mechanical engineer for the Chrysler Corp., died at 49 in Detroit. He was born in Minneapolis.

Disc grinding is described, and a schedule of recommendations for use given in a booklet published by the Norton Co.*

Service and instruction manuals and a pamphlet describing Warner Electric Brake Manufacturing Co. products have been issued.*

The **latest edition** of "Oakite News Service" is available.*

The Columbia Nut & Bolt Co. has issued a **catalog** of its products entitled "One Nut to Another."*

A **catalog** of general purpose tractors has been issued by the Utilitor Co. of Dayton, Ohio.*

Continental Motors Corp. has issued a **leaflet** entitled "6 Outstanding Products."

A new bulletin on the Brown **optimatic or optical pyrometer system** has been published by the Brown Instrument Co. It is No. 91-1.*

A revision of the engineering drafting room chart of **arc welding** procedure is being prepared by the Lincoln Electric Co.*

Victor Manufacturing & Gasket Co. has published a new booklet describing **oil seals** and installation data, together with a listing of sizes.*

A catalog of "Laminum" **shims** has been issued for the Laminated Shim Co.*

The Landis Tool Co. has issued an illustrated **catalog** D-37 covering its 6 in. and 10 in. type C plain hydraulic grinders.*

A new **catalog** and listing of Budd duals, 1937 B 37-2 has been published by the Budd Wheel Co.*

Autocar Adds Long Model

As originally announced, the new cab forward Autocar trucks, Models UA and UB, were made available with three wheelbases 84 in., 106 in. and 124 in. A demand has developed for a wheelbase to carry longer bodies than could be applied to the 124 in. chassis. Therefore, the Autocar factory sales department has announced that a wheelbase of 142 in., suitable for a 16 ft. body, will be made available as an extra immediately. The factory has also announced the availability for those two models of a six-man cab such as is generally used in line construction work by telephone companies.

May Production 12.5% Over 1936

Passenger Car and Truck Output— (U.S. and Canada)

Passenger Cars—U. S. and Canada:	May, 1937	April, 1937	May, 1936	Five Months 1937	Five Months 1936
Domestic Market—U. S.	400,415	410,592	365,457	1,749,461	1,569,526
Foreign Market—U. S.	25,017	29,388	19,464	126,103	96,599
Canada	17,980	12,927	16,389	79,644	73,238
Total.....	443,412	452,907	401,310	1,955,208	1,739,363
Trucks—U. S. and Canada:					
Domestic Market—U. S.	74,390	79,788	63,321	338,056	309,017
Foreign Market—U. S.	17,077	16,566	12,270	77,931	60,450
Canada	5,478	4,154	3,617	24,886	16,310
Total.....	96,945	100,508	79,208	440,873	385,777
Total—Domestic Market—U. S.	474,805	490,380	428,778	2,087,517	1,878,543
Total—Foreign Market—U. S.	42,094	45,954	31,734	204,034	157,049
Total—Canada	23,458	17,081	20,006	104,530	89,548
Total—Cars and Trucks—U. S. and Canada	540,357	553,415	480,518	2,396,081	2,125,140

Newspaper Linage Drops in May

Automotive newspaper advertising in May fell 12.1 per cent behind that for the like month in the preceding year, according to Editor and Publisher. It was further behind 1936 in May than in April despite the fact that May is usually the best selling month of the year. The reason, says the magazine, was the shortage of cars for delivery, due to plant strikes. February has been the only month in which automotive newspaper linage has equaled 1936 figures. For the first five months of the year, the linage has been off about 7 per cent from 1936.

May linage was 7,462,140, against 8,493,445 in May, 1936, of which latter figure it was 87.9 per cent. April linage was 6,956,369, against 7,813,168 in April, 1936. This year the linage was 89 per cent of last year.

World Roads Lengthen

AMA Highways Committee Reports Progress

Additions and improvements to the world's highway system have raised the total mileage to over 9,900,000, according to a report of the highways committee of the Automobile Manufacturers Association for the year 1936. The per cent of increase in world highway mileage since 1929 was put at 50.7, against an increase of 24.2 per cent in world motor vehicle registrations for the same period. Registrations at the close of 1936 were approximately 39,800,000. World highway mileage gained 300,000 last year alone.

Construction and development have not changed the position of the United States with respect to the rest of the world. This country has two-thirds of the motor vehicles and one-third of the highway mileage.

Leading country of the western world from the point of view of 1936 construction activity was Argentina. In Europe, Austria led. In Asia, India was in the forefront of road building operations.

The report cites outstanding pieces of road building during the past year. Steady progress is being made on the 2000 mile All-European Highway, most of which is now paved. It runs southeast from the English Channel to Sofia, Bulgaria. In Germany, a fifth of the projected 5000 miles of express highway network has been built.

France has built belt roads around Paris in the sites of the old city walls, reducing congestion in the city streets. A second belt further out is under way. Four major highways are to be built. One is nearly ready. In Italy, old Roman roads are being remade for modern motor travel. There are already eight express highways. The longest is 78 miles. In England, the high accident toll is bringing cries for better roads, and with Governmental condemnation powers, progress is expected to be more rapid. In Soviet Russia co-ordination of facilities is the keyword and progress is reported steady. Five hundred miles of fast motor roads, with special provision for cyclists are planned for the Netherlands.

Mooney Heads Road Body

Appointment of James D. Mooney, vice-president, General Motors Corporation, as chairman of the highways committee of the Automobile Manufacturers Association, was announced by Alvan Macauley, president of the association.

Mr. Macauley also announced that Robert F. Black, president of the White Motor Company, has been appointed to the committee, other members of which are: A. Edward Barit, president, Hudson Motor Car Company; Robert C. Graham, vice-president, Graham-Paige Motors Corporation and Joseph E. Fields, vice-president, Chrysler Corporation. Pyke Johnson, vice-president and Washington representative of the association is secretary of the committee.

Raises Heater Output

To fill $250,000 of advance orders for its South Wind automobile heaters, the Stewart-Warner Corporation early in July will increase daily production from 1,300 to 2,600 units, according to C. A. Fine, sales manager of the Alemite division of the corporation. Differing from the conventional type, which circulates water from the motor cooling system, the Stewart-Warner heater burns gasoline drawn from the carburetor, and discharges waste gases through the exhaust.

JOHN E. WELLS, advertising manager, Ex-Cell-O Tool Co., has resigned. His future plans have not been announced.

WILLIAM S. KNUDSEN, president of General Motors Corp., will be one of the principal speakers at the mid-summer Scandinavian "fest" to be held in Detroit, June 27. On the same day Mr. Knudsen will be present at the dedication of the Faith Lutheran Church in Detroit which he gave to the parish.

ALVAN MACAULEY, president of the Packard Motor Car Co., received an honorary degree at the commencement exercises of Wayne University.

J. F. LINCOLN, in whose honor was created The James F. Lincoln Arc Welding Foundation, is in England giving a series of talks at the invitation of various engineering societies and institutes.

ROGER W. RICHARDSON, who has been a member of the technical staff of the Standard Oil Company of Louisiana at Baton Rouge is joining the Esso Laboratories of the Standard Oil Development Company at Elizabeth, New Jersey, to head work on motor oils. He will assume his new duties on July 1, 1937.

F. C. RITNER has been appointed assistant to the president of the Carboloy Co., Inc., in charge of special wear resistant applications, new developments, and special products.

W. A. ARMSTRONG has been appointed vice-president of the Nash-Kelvinator Corp. He has been associated with General Motors Corp. in the Delco-Remy, Olds and Frigidaire divisions.

MALCOLM F. JUDKINS has been appointed chief engineer of the Firthite division of the Firth-Sterling Steel Company of McKeesport, Pennsylvania.

Globe

STREAMLINING as applied to a new German bus. The driver's seat is located between the two floors for vision. Seats are arranged to provide a window view for each passenger. The bus is called "Zepp of the Streets."

Business in Brief

Written by the Guaranty Trust Co., New York

Rebound Appears

After the sharp decline in general business activity in the preceding week, a substantial upturn occurred last week. Strikes in the Middle West, however, continued to retard several branches of industry. The weekly index of business activity compiled by the "Journal of Commerce" stood at 99.8, as against 95.7 the week before and 91.2 a year ago.

The Government's weekly crop report states that the warm weather crops in the interior and the Northwest, such as corn, made slow progress last week because of cloudy weather, subnormal temperatures, and frequent rains. Other crops, such as grain and grass, showed a satisfactory growth.

Railway freight loadings during the week ended June 12 amounted to 754,360 cars, which marks an increase of 62,220 cars above those in the preceding week, a gain of 67,717 cars above those a year ago, and a rise of 102,249 cars above those two years ago.

Food Costs Up

According to the Department of Labor, retail food costs rose 1.0 per cent during the month ended May 18. The department's index on that date stood at 86.5, based on the 1923-25 average as 100, as compared with 85.6 a month earlier and 79.9 a year ago. The largest part of the current rise was due to an advance of 4.4 per cent in the cost of fresh fruits and vegetables.

According to the Board of Governors of the Federal Reserve System, department store sales last month advanced seasonally. The adjusted index for that month stood at 93, the same as for the two months preceding, as compared with 87 a year ago.

Production of electricity by the electric light and power industry in the United States during the week ended June 12 was 13.8 per cent above that in the corresponding period last year.

Fisher Figure Dips

Professor Fisher's index of wholesale commodity prices for the week ended June 19 stood at 91.9, as compared with 92.0 the week before and 92.6 two weeks before.

The consolidated statement of the Federal Reserve banks for the week ended June 16 showed a decline of $1,000,000 in bills bought in the open market. Holdings of discounted bills and of Government securities remained unchanged. Money in circulation declined $20,000,000, and the monetary gold stock rose $102,000,000.

Parts Workers' Pay at Peak

The highest hourly average rate of pay, the highest weekly average earnings and the largest total payrolls ever reported by 48 original equipment manufacturing plants are shown in the figures for the four weeks ended May 1, published by the Automotive Parts and Equipment Manufacturers, Inc. The average rate of pay rose to 80.2 cents an hour, the average weekly earning to $30.91 and the total payroll for the 48 plants for the period to $10,433,000.

Production for the period covered was only 2.7 per cent less than in 1929 and the number of persons employed 29.5 per cent greater.

The average number of hours per week in the 40 hour divisions was 38.1, against 37.4 in the preceding period, and against 41.7 in the like period of last year. In the 42 hour divisions, the average was 41 against 41.3 in the preceding period and against 43.5 a year earlier.

The average weekly earning of $30.91 compared with $30.01 for the preceding period and with $28.67 for the like period of the preceding year.

A group of 22 replacement parts plants reported average weekly earnings of $25.29 for the four weeks ended April 3, against $24.83 for the preceding period and against $21.88 a year earlier. Average hours per week in the 40 hour divisions were 42.9 against 43.4 and 38.6. In the 42 hour divisions the averages were 44.5 against 45 and 43.2.

. . . slants

HOW DO THEY DO IT?—*Not a bill board is to be seen on 10,000 miles of highway in Victoria, Australia, says the chairman of the county roads board from that part of the world. He adds that there are no signs on buildings for 2000 miles either.*

HAZARDS—*Trees and hedges are noteworthy additions to the beauty of roads and streets, but when they grow so that they overhang and obscure warning signs, they are a definite travel hazard. In several localities steps are being taken to improve the situation.*

HE LIKES CARS—*The Maharajah of Mysore has no less than 66 cars and 44 chauffeurs, says the Autocar of London. Most of them are English and American. There are eight Rolls-Royces, including the first of that make which went to India. American makes include Ford V8, Chevrolet, Buick, Chrysler, Studebaker, Dodge, Overland and Essex Terraplane. There are also a trailer and several electrics. Total gasoline consumption is something like 2000 gals. a month.*

More Stock Sales Shown

A second set of reports of April stock transactions by officers, directors and large stockholders, as compiled by the Securities and Exchange Commission, show the following, alphabetically arranged:

E. L. Cord acquired another 1000 shares of American Airlines, Inc. common and held 27,377 at the end of April. In February, C. L. Best, director of the Caterpillar Tractor Co., sold 1550 shares of common and held 5000 directly. He held 15,000 through a trust. E. S. Evans, Sr., officer and director of Evans products Co., reported that through the Saven Corp. he had acquired 3952 shares of stock and held 18,726. Last February, N. A. Woodworth, officer and director of Ex-Cell-O Corp., acquired 2583 shares as compensation and in March disposed of 3000, holding 6090. John W. Thomas, officer of Firestone Tire & Rubber Co., last March gave away 4000 shares of stock in two equal blocks. He held 13,610.

Six gifts of 150 shares each of General Tire & Rubber Co. common were made last December by W. F. O'Neil, officer. In January, J. A. Diebolt, a director, sold 1500 shares. Both held large blocks. In December, 1936, J. B. Swan, officer, director and large holder of Kermath Mfg. Co. stock, disposed of 3500 shares and held 1084. Jointly with his wife, he disposed of a further 5000 and held 9500.

G. D. Keller, officer of the Studebaker Corp., received 250 shares as compensation in September, 1936, sold 200 in October, bought 250 in December, sold 300 in January, and received another 188 as compensation in March. C. O. Roemler, director of Stutz Motor Car Co., bought 400 shares in April and July, 1936, sold 100 in November and 500 in January, 1937.

S. L. Mather, director of Thompson Products, Inc., bought 100 shares and holds 950. The F. R. Fageol Corp. distributed 1590 shares of Twin Coach Co. stock in exchange for its own shares and holds 98,050.

Bender Body Shipments

The Bender Body Co. reports that shipments in the first fifteen days of May totaled $150,000. At the present time, both the Cleveland plant and the Elyria plant are behind on orders, but this condition is now being remedied with the addition of new equipment.

Books of automotive interest

"Messung und Berechnung von Kolbentemperaturen in Dieselmotoren." (Measurement and Calculation of Piston Temperatures in Diesel Engines), by K. Hug, Dr.-Ing. Published by Gebr. Leemann & Co., Zurich, Switzerland.

This publication forms No. 1 of Reports from the Department of Thermodynamics and Internal Combustion Engines of the Federal Technical College, Zurich, and is an enlargement of a thesis prepared by the author some years ago. It deals with temperature distribution in the pistons of double-acting, two-stroke Diesel engines of relatively large cylinder size. Piston temperature measurements were made on an engine of about 15 in. bore and 18 in. stroke and complete temperature-distribution charts were prepared for the combustion-chamber walls, including piston, cylinder head and liner. The effects of various changes in piston design on the maximum piston temperature are investigated analytically on the basis of the experimental results.

The publication also contains a chart showing the variation of the maximum piston temperature and of the heat absorbed by the piston with cylinder bore, for both cast iron and aluminum alloy.

"Autobücherschau, 1936." Compiled by Dr. E. W. Böhme. Published by the Reichsverband der Automobilindustrie, E.V., Berlin-Charlottenburg, Germany.

This is a list of all books on the automobile movement published in Germany during 1936 and includes also publications of several fields related to that of motor transportation (motor fuels, road construction, traffic problems, maps, etc.). The same as automobile production, the production of books having anything to do with motor vehicles and motor transport again increased in Germany in 1936 and the publication under review lists 850 titles with approximately 900 volumes. Germany in 1936 celebrated the fiftieth anniversary of the motor vehicle and a number of the books listed are of an historical character. Another topic that formed the basis of a book publication is the proposed revision of the law pertaining to compulsory insurance. One quarter of all the new publications relate to technical subjects, and among these the books dealing with materials of construction occupy a prominent place. Then there are books devoted to the new automobile roads, to the motorization of the army, and to the production of native fuels.

GM Overseas Sales Gain

Sales of General Motors cars and trucks to dealers in the overseas markets during May totaled 33,306 units, representing an increase of 7.4 per cent over the volume in May of last year.

In the first five months of 1937, sales of 154,609 represented an all-time high volume for that period, and an increase of 5.4 per cent over the volume in the first five months of 1936. For the twelve months through May 1937, sales totaled 332,688 units, an increase of 7.4 per cent over the volume in the twelve months ended May 31, 1936.

These figures include the products of the corporation's American, Canadian, English, and German factories sold outside of the United States and Canada.

Platt Trailer Expands

The Platt Trailer Company, which has been operating at Elkhart and Osceola, Ind., will move to South Bend and start production within a few days. The concern will occupy 25,000 square feet of space in the Huntsberger Building, situated south of the New York Central railroad tracks and west of Ironwood Drive. The company, which has been operating on a capacity of two trailers a day and employing 20 persons, expects to increase its output from eight to ten trailers a day and employment from 75 to 100 carpenters, woodworkers and assembly mechanics.

Automotive Metal Markets

Moderate Upturn Reported in Orders for Automotive Strip and Sheet; Mill Customers Make Some Shifts in Sources

A mild increase in flat steel buying by automobile manufacturers has been noted in the last few days, furnishing a prop for the hopes of steel sellers that by the middle of next month covering of body stock requirements for 1938 models will have attained full momentum. In some cases definite specifications and shipping orders accompanied sheet orders.

Many of the finishing mills still have extensive backlogs and, with fresh business beginning to make its appearance, the outlook is generally considered promising. Parts makers are replenishing sizes and grades of strip steel, of which they have run short and which are for parts of current model assemblies. Some of the parts makers, however, are credited with still having fair-sized reserves of strip steel. Better automotive demand is noted by wire manufacturers. Some of the wire mills have booked round tonnages, subject to later specifications and shipping instructions. Non-integrated finishing mills have been placing good-sized orders for semi-finished descriptions of steel.

Curiosity continues unabated as to the extent of the shift in sources of supply forced upon customers of strike-bound mills. Nearly all of the important steel consumers are in the habit of dividing up their business more or less, so that inability on the part of one mill to make shipments on time merely means a temporarily larger slice of the business for other regular sources of supply. Strike-affected mills lose volume for a time, but they hardly lose important customers. The risk of losing customers is confined to rather negligible tonnages from smaller buyers who more often than not flit from mill to mill in quest of the utmost in the way of accommodation.

It is clearly recognized today that there has been a perfectly normal, seasonal recession in the demand for steel. Operations this week are estimated by the American Iron & Steel Institute at 75.9 per cent of ingot capacity, compared with 91 per cent a month ago. Part of the high rate at which mills in some of the districts unaffected by strikes are operating, over 90 per cent in the Pittsburgh district and at close to that level in the Buffalo area, results from a shift of orders from Youngstown and Cleveland where operating rates are well below 50 per cent. But it must also be borne in mind that uneasiness over possible delivery delays has served to "smoke out" considerable business in the heavier rolled steels, chiefly needed in the completion of structural contracts. These would naturally go to the heavy products mills in the Pittsburgh district.

Pig Iron—The market is quiet and unchanged. Some of the blast furnaces are beginning to stock pig iron in their yards.

Aluminum—If Germany's four-year plan is achieved, her production of aluminum, press dispatches report, will be 200,000 metric tons a year by 1940, which would make her the world's largest producer. The market for both primary and secondary aluminum is quiet and unchanged.

Copper—With the export price rather easy at around 13½ cents, the market lacks support from that quarter and domestic bookings run light. Electrolytic continues to be quoted at 14 cents.

Tin—Spot Straits tin was offered at 55⅝ cents at the beginning of the week and on Tuesday firmed a shade, being quoted at 55⅝ cents. The market is strictly professional.

Air Products Output Large

Deliveries of aircraft, engines and equipment for the first five months of the year totaled $39,435,602 against $24,477,922 for the 1936 period and against approximately $79,000,000 for the full year 1929. The figures were announced by L. W. Rogers, president of Aeronautical Chamber of Commerce of America.

The civil aeronautics industry in the United States produced aircraft, engines, equipment and spare parts valued at $78,148,893 in 1936, and furnished employment for more than 30,000 persons, the Bureau of Air Commerce, Department of Commerce, announced.

Number and value of engines were not included in the totals for aircraft, but were compiled separately. In all, 4,295 aircraft engines were built which, together with spare parts, were valued at $26,383,055.

The totals cover all aeronautical production, including aircraft and equipment for civilian use, for military deliveries and for exporting to purchasers in foreign countries.

40 Years Ago

with the ancestors of AUTOMOTIVE INDUSTRIES

"Principles of Traction"

A letter to the editor by G. H. Edwards

We have not as yet got an explosive engine that will do as well as the above [*ed. note;* steam traction engine, three cylinder compound], although we are working that way and we want it.

It should be one to use crude oil, that is one-third the cost of gasolene and not so troublesome by evaporation in the hot sun as gasolene is. We want a constant supply of air, a certain explosion every time (no hit or nip), the explosion to be stronger or weaker by the governor, according to the resistance of the road.

Three or four cylinders, so as to do away with as much flywheel as possible.

As to cooling water for the cylinder, after using a pound of water in steam through an engine there is still about 800 units of heat to take out of it to gt it back to water again.

A gas engine will use as much or more water for horse-power than a steam engine, but it only puts about 100 units of heat into a pound of water. So it shou'd be far easier to take out the 100 units of heat by an air current from the pound of water used by a gasolene engine than to take out the 800 from the pound converted into steam. Both have been done. It now remains to develop the best way of doing it.

From *The Horseless Age,* June, 1897.

June Output Behind Schedules

(Continued from page 923)

vehicles during the first four months of 1937 were up 21 per cent over the corresponding period in 1936. The heavier stocks are therefore not as big a problem as were the stocks held by dealers a year ago, since turnover is more rapid. There has been a slight slowing down in used car sales recently, which condition sales officials lay to the widespread strikes.

Car Registrations Drop

New passenger car sales in the United States for the month of May were 182,436 in the 31 states reporting registrations for the R. L. Polk & Company analysis.

That figure is minus 1.18 per cent compared with the same month last year and is minus 2.34 per cent compared with the same number of states reported in April. Total sales in April were 385,277.

Truck sales for 30 states in May are running 5.91 per cent ahead of the same month last year and minus 9.38 per cent compared to April sales in the same number of states. May sales in the 30 states reporting total 26,346, indicating that the Polk estimate of 63,000 truck sales in May will be reached.

AUTOMOTIVE INDUSTRIES

Looking Ahead

TAXATION of motor vehicles. Believe it or not, there's a new approach to the reason why motor-vehicle taxes should be lowered. Riley E. Elgen, chairman of the Public Service Commission of the District of Columbia, and a well known writer on transportation economics provides the answers in a beautifully reasoned article to appear soon—and exclusively—in Automotive Industries. MOTORIZATION and mechanization to the Ordnance Department of the Army signify the use of internal combustion engines; but there the similarity between the functions of the two words ends. What significance have both words to the Army and to all of us, and what has the automotive industry to do with both. Major John K. Christmas of the Ordnance Department tells, as much as can be told, in an article which will initiate a series on every aspect of motor-vehicles in the military (and naval) life of the nation. Coming soon.

Hudson Road Shows Start

The Hudson Motor Car Co. will start 70 road shows during the next few weeks. They will include the cars, educational pictures and a new four-reel film. The first road show were preceded by a meeting of 2000 factory and distributing staff men at the headquarters of the Aaron DeRoy Motor Car Co.

Plant Notes

The B. F. Goodrich Co. announces that it will spend $600,000 within the next six months modernizing machinery, processes and equipment in its Akron reclaiming plant. A contract for $109,000 has already been awarded as a starter in this improvement project.

The Hall Manufacturing Co., Toledo, makers of valve seat grinders and cylinder hones, has purchased a three-story concrete and steel building adjoining its plant for a consideration of about $50,000. The new space was made necessary by the development of large automatic machines for grinding of all valve seats on an engine block simultaneously. About $25,000 in new equipment will be installed and 60 additional workmen added to the force.

Jacobsen Mfg. Co., Racine, Wis., maker of gasoline engine powered lawn mowers for country clubs, estates, etc., has purchased a 4-story section, 60 x 75 ft., of the factory of the former H. & M. Body Corp., Racine, from Murray Body Corp. The rest of the factory is being razed. The purchase is part of an extensive enlargement program by the Jacobsen company.

General Plastics, Inc., announces the opening of a Detroit office in the New Center Building. The office is in charge of J. S. Miller, and a service man will shortly be added to the Detroit staff.

Calendar of Coming Events

SHOWS

Morocco, Automobile Section, Tangier Fair, Tangier .....June
France, Automobile Section, Bordeaux Fair, Bordeaux .....June 13-28
Belgium, First International Aeronautical Salon, Brussels.....June 18-30
Detroit Diesel Engine Show.....June 26-27
Fourth ASTM Exhibit of Testing Apparatus and Related Equipment, New York .....June 28-July 2
Second Winter Item Show, Automobile Accessories Association, Chicago, Aug. 9
Poland, Automobile Salon (Foire Orientale), Lwow .....Sept. 1-15
Yugoslavia, Automobile Section, Autumn Fair, Ljubljana .....Sept. 1-12
Yugoslavia, Automobile Section, Commercial Fair, Belgrade.....Sept. 11-21
France, 31st International Automobile Salon, Paris .....Oct. 7-17
Great Britain, 31st International Automobile Exposition, London....Oct. 14-23
Czechoslovakian Automobile Show, Prague .....Oct. 16-24
National Automobile Show, New York, Oct. 27-Nov. 3
Toledo, O., Automobile Show..Oct. 27-Nov. 3
Italy, 10th International Automobile Salon, Milan .....Oct. 28-Nov. 8
Boston, Mass., Automobile Show, Oct. 30-Nov. 6
Los Angeles, Cal., Automobile Show, Oct. 30-Nov. 7
San Francisco, Automobile Show, Oct. 30-Nov. 7
Cincinnati Automobile Show.Oct. 31-Nov. 6
Great Britain, 13th International Commercial Automobile Exposition (trucks and buses), London...Nov. 4-13
Chicago Automobile Show.....Nov. 6-13
Akron Automobile Show.....Nov. 6-12
Omaha Automobile Show.....Nov. 6-11

Show Business

Manager of the National Automobile Show in New York is Alfred Reeves, 366 Madison Ave., N. Y. C. Inquiries concerning all matters connected with the national show should be addressed to him. AUTOMOTIVE INDUSTRIES will be pleased to furnish names and addresses of local show managers on request.

Brooklyn Automobile Show.....Nov. 6-13
Columbus Automobile Show .....Nov. 6-12
Detroit Automobile Show.....Nov. 6-13
Motor Truck Show, 4th Annual, Newark, N. J. .....Nov. 6-12
Newark, N. J., Truck Show.....Nov. 6-12
Buffalo, N. Y., Automobile Show..Nov. 6-13
Indianapolis, Automobile Show....Nov. 6-13
Newark, N. J., Automobile Show..Nov. 6-13
Philadelphia Automobile Show....Nov. 6-13
Pittsburgh, Pa., Automobile Show.Nov. 6-13
Toronto, Ont., Automobile Show..Nov. 6-13
Great Britain, 36th Scottish International Automobile Exposition, Glasgow .....Nov. 12-20
Baltimore, Md., Automobile Show, Nov. 13-20
Cleveland, Ohio, Automobile Show, Nov. 13-20
Jersey City, N. J., Automobile Show, Nov. 15-20
Milwaukee, Wis., Automobile Show, Nov. 17-24
Springfield, Mass., Automobile Show, Nov. 14-20
St. Louis, Mo., Automobile Show.Nov. 14-21
Portland, Ore., Automobile Show.Nov. 14-21
Denver, Colo., Automobile Show, Nov. 15-20
Montreal, Que., Automobile Show, Nov. 20-27
Kansas City, Mo., Automobile Show, Nov. 27-Dec. 4

CONTESTS

Roosevelt Raceway, 300-Mile George Vanderbilt Cup Sweepstakes (Rain date July 5) .....July 3
31st Annual Grand Prix of the Automobile Club of France, Linas-Montlhéry .....July 4
National and International Soap Box Derby Finals, Akron, Ohio.....Aug. 15
Pan American Cup Race, Roosevelt Raceway .....Sept. 6
National Outboard Championship Regattas, Richmond, Va.....Sept. 18-19

CONVENTIONS AND MEETINGS

American Society for Testing Materials, 40th Annual Meeting, New York, June 28-July 2
U.A.W. Annual Convention, Milwaukee, Aug. 23
American Transit Association, 56th Annual Convention, White Sulphur Springs, W. Va.....Sept. 19-23
American Foundrymen's Association Midyear Meeting, Columbus, Ohio, Sept. 30-Oct. 1
S.A.E. Fuels and Lubricants Regional Meeting, Tulsa, Okla. ...Sept. 30-Oct. 1
S.A.E. National Aircraft Production Meeting, Los Angeles, Calif.....Oct. 7-9
American Foundrymen's Association, Regional Conference, Rolla, Mo., Oct. 8-9
S.A.E. Annual Dinner, Commodore Hotel, New York.....Oct. 28
American Petroleum Institute, 18th Annual Meeting, Stevens Hotel, Chicago .....Nov. 8-12
S.A.E. National Production Meeting, Flint, Mich. .....Dec. 8-10

Just Among Ourselves

Generalizations Sometimes Backfire

IT is often assumed that nearly all automobile dealers deal exclusively in the products of one manufacturer. The Federal Trade Commission thinks so, to judge by its last week's complaint that General Motors was violating the exclusive dealing prohibitions in the Clayton Act.

This week we had occasion to look up some figures on dealerships for one of the automobile company statisticians. "How many of our dealers" (in 12 specified states), he asked, handle competing makes?

In the states specified by our inquirer his company has 1592 dealers handling two lines of cars manufactured by the company. Of these 1592 dealers, 101 handle competing lines of cars which in variety pretty well blanket the industry.

Such conditions exist, apparently, in rural districts sparsely settled. Distributorships in such territories have a lot of dealers who are not fine-tooth combed by factory representatives. Many of such dealers are agents only, without any more stock than a single demonstrator which doubles in brass as the dealer's personal car, etc.

The figures quoted above are not intended to prove anything except that we're a big industry in a big country, and that generalizations by the Federal Trade Commission or anyone else, when applied to such conditions, are likely to backfire.

Of the 101 dealers' names above, about 45 are handling General Motors cars in conjunction with a competing line. Such dealers, presumably, are not supplying GM parts for competing cars. Standardization hasn't gone that far yet.

Caterpillar Technique Worth Study

THE record of the Caterpillar Tractor Co. in handling its employee relations continues to amaze us by its brilliant simplicity, in the face of infinitely more complex (and less successful) solutions which have been our daily newspaper diet for a good many weeks.

The Peoria plants of Caterpillar have about 11,000 employees which takes the problem out of the small-change class. C.I.O. demands at Peoria were licked by complete publicity of the negotiations (see AUTOMOTIVE INDUSTRIES, May 1, p. 641).

At San Leandro, Cal., the company maintains a plant employing about 800. C.I.O. demands at San Leandro were wrapped up in a company-dictated agreement which took just one public meeting to put over. As in the Peoria case, the company has published the record of the San Leandro meeting in booklet form. If your job involves any aspect of labor relations, you wouldn't waste time by asking for a copy and reading every word.

Less Restriction—More Confidence

LAST November we noted (AUTOMOTIVE INDUSTRIES, Nov. 7, 1936, p. 610) that public confidence in the automobile industry, as illustrated by the stock-market behavior of automotive stocks, had continued undiminished throughout the worst of the depression years.

At the end of 1936 large corporations numbering 180 in a study conducted by Frazier Jelke & Co., brokers, had lost stockholders to the tune of about 0.8 per cent. Of the largest corporations in the group, General Motors was one of three which showed an increase in recorded stockholders.

The brokers' comment: "Of the several classifications of stock examined, it is interesting to note that companies less subject to governmental restriction proved the most popular with stockholders."

Uneasiness over the threat of labor difficulties is listed as one of three reasons why other corporations lost ground in the public's mind. Apparently with all General Motors' difficulties of this sort, the public generally has no reason to criticize the corporation's record. —H. H.

Ricksha Bows to Sanrinsha-

"SANRINSHA" (tricycle) is the generic name given in Japan to three-wheeled motor carriers. Although such machines were produced as early as 1928, they have been manufactured appreciable numbers only since 1934, and they were separately classed in the foreign-trade returns for the first time last year, when about 5,000 units were exported. Brazil is easily the largest foreign market for this type of machine; then follow Manchukuo, the Dutch East Indies, China, British India, Ceylon, and other South American countries.

Basically the "sanrinsha" is a three-wheeled motorcycle with two rear wheels, equipped with an engine of either one or two cylinders. The weight of the engine and of the operator is supported mainly on the front wheel, while the body, which is usually designed for the transportation of merchandise, is balanced over the two rear wheels. The pay-load capacity usually ranges between 800 and 1600 lb. In Japan this type of vehicle can be operated without a driver's license, provided the piston displacement of its engine does not exceed 45 cu. in. There are some thirty different makes of this type of vehicle on the Japanese market at present, most of them having a piston displacement of 40 cu. in. The over-all length is usually less than 120 in. and both the width and the height are less than 52 in.

Great improvements have been made in the design of these vehicles recently, and many of them are now capable of negotiating 16 per cent grades with a full load. By replacing parts as they wear out—which is facilitated by the fact that all parts are made to standard specifications common to all makes—the machines may be kept in service for years. Japanese engines have now completely replaced engines of foreign make, such as the British J.A.P. and the Swiss M.A.G., but the largest manufacturer, the Toyo Kogyo Kabushiki Kaisha, and some others still equip their machines with British-made "Amal" carburetors.

The New Era, Tsubasa, Mazda, and Daihatsu have been using their own engines from the start, while the M.S.A., Ikegai, Welby, Yamarta, and Giant at first were fitted with imported engines. In the early days of the "sanrinsha" a police ruling limited the piston displacement that gave exemption from the requirements of a driver's license to 21 cu. in. However, it was found that these miniature engines did not give sufficient power to enable the motor-propelled carriers to compete with pedal cycles with trailer, and the police raised the limit, first to 30.5 and then to 45 cu. in. Continued experimenting within the limits thus set by law led the manufacturers to the conclusion that 40 cu. in. is about the best displacement for this type of vehicle, as it ensures both satisfactory handling and economical operation.

Single-cylinder engines are the rule, though a few makes with the limiting displacement of 45 cu. in. have twin-cylinder engines. At present L-head engines predominate, but valve-in-head designs seem to be in the ascendancy. The compression ratio used is generally moderate, as this makes for easy

Specifications of the Japanese Made Sanrinsha (Three-wheel) Models

Trade Name	No. o. Cylinders Bore and Stroke (mm)	B. H. P. at specified r. p. m.	MATERIALS				
			Cylinder	Piston	Connecting Rod	Crankshaft	Valves
Anzen	1-95.2 x 105	14-1,800	Ni. Cast Iron	Al. Alloy	0.8% C. Steel	3% Ni. Steel	Sil-chrome
Daihatsu	1-90 x 105	8.5-1,800	Cast Iron	Spec. Lig. Alloy	Ni-Cr. Steel	Ni-Cr. Steel	Ni-Cr. Steel
Daihatsu	1-95 x 105	10-1,800	Cast Iron	Spec. Lig. Alloy	Ni-Cr. Steel	Ni-Cr. Steel	Ni-Cr. Steel
Giant	1-91 x 100	24-5,500	Ni-Cr. Cast Iron	Y Alloy	Ni. Steel	Ni-Cr. Steel	Si-Cr. Steel
Giant*	2-71 x 90	19-3,600	Ni-Cr. Cast Iron	Y Alloy	Ni. Steel	Ni-Cr. Steel	Si-Cr. Steel
Haneda	2-68 x 68	12-4,000	Ni-Cr. Cast Iron	Mg. Alloy	Ni-Cr. Steel	Ni-Cr. Steel	
H. M. C.	1-90 x 103						
H. M. C.	2-71 x 94						
J A. C. (New Era)	1-87.5 x 108	15.5-3,500		Al-Si. Al oy			
J. A. C. (New Era)	2-70 x 97	16.5-3,500		Al-Si. Alloy			
Mazda	1-85.72 x 84.14	9.4-3,300	Cast Iron	Al. Alloy	Ni. Steel	Ni-Cr. Steel	Steel
Mazda	1-89.5 x 104	13.2-3,300	Cast Iron	Al. Alloy	Ni. Steel	Ni-Cr. Steel	Steel
Yatsuka	1-90 x 104	13.2-3,000	Pearlitic Steel	Y Alloy	Med.CarbonSteel	Ni-Cr Steel	Sil-chrome
Yamarta	1-85.7 x 105		Cast Iron	Y Alloy	Alloy Steel	Alloy Steel	Alloy Steel

* Note—Water-cooled

Japanese makers of three-wheeled service vehicle introduce semi-floating axles, shaft drive with spiral-bevel gear and constant mesh transmissions

1. NEW ERA negotiating a gradient. Powered with single cylinder air-cooled J.A.C. engine of 40.5 cu. in. piston displacement Price, 950 yen.

starting, 4.5 and 5 being common, while the maximum is 5.8. The fuel capacity is generally about 3 quarts, and electrically welded tanks are replacing those of the soldered type. Ignition is by the battery system, the equipment of the Hitachi Works being used almost exclusively. Spark-plug threads are 18 mm. All except two or three of the engines are air-cooled.

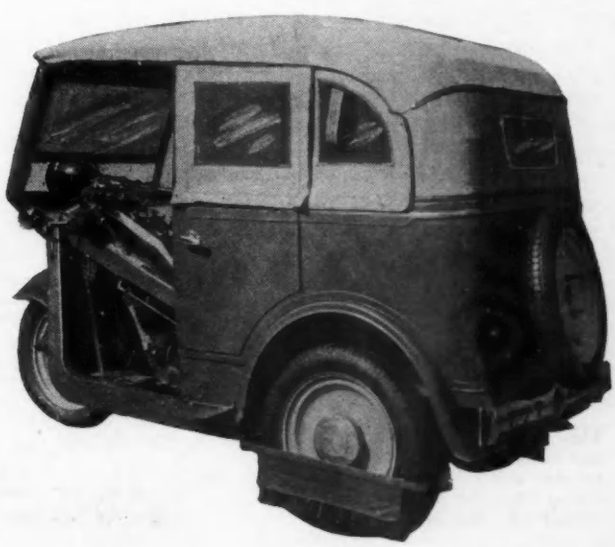
While chain drive is still the rule, a number of the more progressive makers have adopted shaft drive with floating or semi-floating axles. With the latter the final drive is generally by spiral bevel gears. In the latest Yatsuka, Fujiya and Mazda models the chain has been discarded also as the first link in the drive line. The gear box and clutch are built integral with the engine.

Clutches are generally of the dry disk type, and are operated by the left pedal. The Mazda has a patented (Japanese patent No. 93,312) constant-mesh transmission, all others have progressive transmissions. Kick starters are standard equipment on all makes.

Steel tubing as a frame material is being replaced by pressed steel and forgings. Wheel rims are usually designed to take 4.00/26 in. tires.

Although all makes seem to be more or less identical in design except for differences in the drive, the accompanying table (based upon a compilation by a native trade publication) shows that there are great divergencies even with respect to such fundamental matters as the stroke/bore ratio.

2. MAZDA sanrinsha, made by the Toyo Kogyo Co., Ltd., Hiroshima, Japan. Powered by 40.5 cu. in. engine. Price 1,100 yen.



3. MAZDA "ricksha" model. Almost all sanrinsha makers are developing a vehicle intended to replace the man-pulled "ricksha" in Oriental countries.

Turbo Transmissions —

AFTER expensive experience with automatic mechanical transmissions the interest of automobile engineers is becoming focused on the turbo drive, which is not sensitive and is comparatively easy to build. The author built an experimental turbo torque converter (Fig. 1) some six years ago and has been using it in an experimental car ever since. Two articles by the writer on the subject of turbo transmissions have appeared in previous issues of AUTOMOTIVE INDUSTRIES (September 12, 1931, and July 8, 1933). In the present article an effort is made to explain some of the theoretical and practical features of this new, interesting turbo mechanism. It is believed that the following discussion also will help to correct some wrong impressions with reference to the design of centrifugal pumps and fans.

A turbo torque converter is a combination of a pump impeller, a turbine runner, and a reaction member or guide wheel, all enclosed in a suitable fluid-retaining housing. If we designate the fluid pressure by p, the velocity of the fluid by v, and the hydrostatic head by h,

$$p = hk \tag{1}$$

$$v = \sqrt{2gh} \tag{2}$$

$$h = v^2/2g \tag{3}$$

where k is the weight of unit volume of the working liquid and g the acceleration of gravity.

The basic formula for calculating the torque exerted by the impeller is

$$t = m\,(r_o s_o - r_i s_i); \tag{4}$$

The power imparted by the impeller to the liquid is

$$e = m\,(u_o s_o - u_i s_i); \tag{5}$$

The torque available on the runner shaft is

$$T = m\,(R_o S_o - R_i S_i) \tag{6}$$

The additional torque created by the guiding wheel is

$$T' = m\,(R'_o S'_o - R'_i S'_i) \tag{7}$$

Where f is the flow velocity (radial velocity for radial-blade wheels, axial velocity for axial-blade wheels or channels);

m, the mass of liquid flowing per second;

r_o, r_i, the radii of discharge and inlet respectively;

s_o, s_i, the tangential components of the absolute fluid velocity v at the outlet and inlet respectively;

ω, the angular velocity, and

u, the circumferential velocity at a point of the impeller.

Forced-Vortex Law

Where a mass of liquid is rotated bodily

$$u = \omega r \tag{8}$$

The increase or decrease of pressure head between the inlet or the outlet of the impeller or turbine due to centrifugal force is

$$dp/dr = ku^2/gr \tag{9}$$

or

$$h_u = (p_o - p_i)/k = (u_o^2 - u_i^2)/2g \tag{10}$$

The energy increase of the fluid in motion due to a change in absolute flow velocity is equal to the velocity head—

$$h_v = (v_o^2 - v_i^2)/2g \tag{11}$$

Owing to the flow between vanes, fluid velocity is converted into pressure or pressure head in accordance with the following equation—

$$h_w = (w_i^2 - w_o^2)/2g \tag{12}$$

The total change of pressure in the fluid on passing through the blade wheels is

$$h = h_u + h_w \tag{13}$$

What is known as the Bernoulli equation, viz.,

$$v^2/2g + p/k = \text{constant} \tag{14}$$

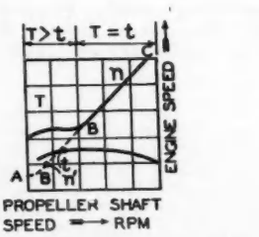
applies to each streamline of the fluid circuit, changes in altitude being neglected.

Free Vortex

Between the blade wheels that are passed successively by the liquid in motion, that is, between the blades of the impeller and turbine, the turbine and guide wheel, and the guide wheel and impeller, there is always a space without vanes, in which a free vortex is being formed. The law of this flow may be derived from equation (4), for there are no vanes in the channel and there is no deviation in the direction of the flow there, hence no angular momentum is introduced in the fluid in this space. Therefore, in equation (4) we can make $t = O$, which gives

$$r_o s_o - r_i s_i = O \tag{15}$$

This very important theorem of the free vortex can be proved also by means of the Bernoulli equation (14), which when differentiated and divided by dr gives



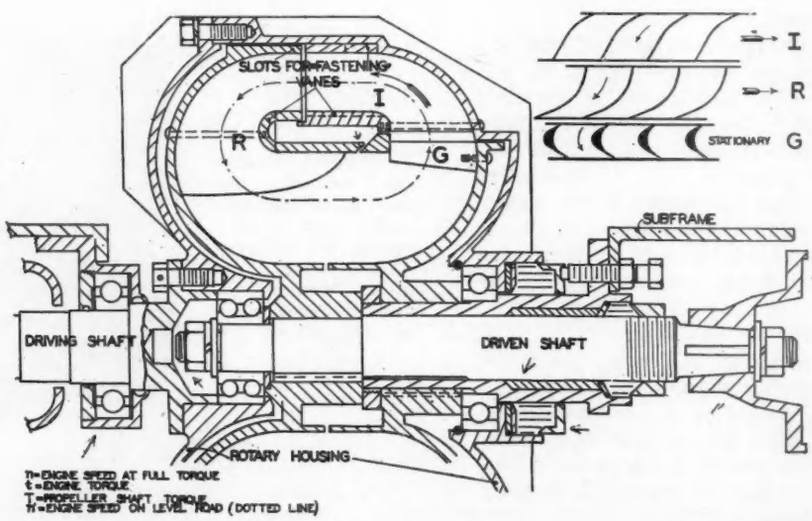


Fig. 1—Sectional view and characteristic curves of an early model of turbo - torque converter made by the author

Some wrong impressions are corrected. Theoretical and practical features are discussed

By Joseph Jandasek,* M.E., E.E.

$$dp/kdr + sds/gdr = O$$

Substituting for dp/dr its value in equation (9) we get

$$s^2/gr + sds/gdr = O$$

and

$$ds/s = -dr/r.$$

Integrating, $\int ds/s + \int dr/r =$ constant we get

$$lg_n s + lg_n r = \text{constant},$$

and, finally,

$$sr = \text{constant},$$

which is the same as equation (15).

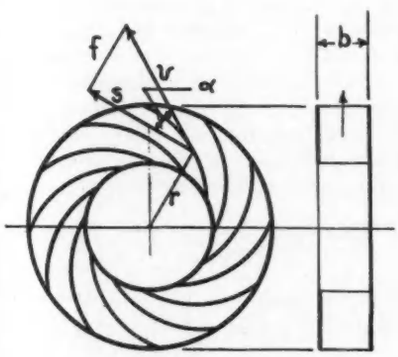


Fig. 2—Free vortex between parallel walls

By a free cylindrical vortex is understood a mass of liquid rotating freely in circular paths, while a free spiral vortex is a mass of fluid moving spirally toward the center (or away from it), with a streamline motion, so that its energy per unit of mass is the same everywhere. A free spiral vortex may be considered as a case of cylindrical vortex motion combined with radial motion.

Free Vortex in Channel with Parallel Walls

Referring to Fig. 2, because of the continuity of the flow and the incompressibility of the fluid, the width b of the channel being considered constant,

$$\text{Flow velocity } f = \text{constant} / r \qquad (17)$$

As shown above, the law of the free vortex is $s\ r = \text{constant}$, or $s = \text{constant} / r$; consequently,

$$f/s = tan\ \alpha = \text{constant} \qquad (18)$$

Angles α of streamlines with the tangent are constant.

Flow Through Channel of Constant Cross Section and Curvature

In Fig. 3, where there are no blades in the channel, the angular momentum of the fluid in the channel is not changed, and the flow therefore conforms to the law of the free vortex, so that

$$rv = r_n v_n = r_1 v_1 = r_2 v_2 = \text{constant} \qquad (19)$$

The velocity v of the streamlines changes according to an equilateral hyperbola with a line through the axis as asymptote, the velocity increasing with a decrease in the radius. The neutral radius or the radius of the average velocity v_n is given by the equation

$$r_n = (r_2 - r_1) / lg_n (r_2/r_1) \qquad (20)$$

The average velocity v_n in the curved channel is equal to the flow velocity at the beginning of the curve.

The pressure in the channel at a point of radius r can be determined as follows: Knowing the velocity v from equation (19), we calculate the corresponding pressure p by means of Bernoulli's equation—

$$p/k + v^2/2g = p_n/k + v_n^2/2g \qquad (21)$$

Equations (4) to (7), which are given in textbooks on turbines, are correct only for wheels with a relatively large number of vanes (sometimes called cell-shaped vanes), where the fluid stream can be considered completely and uniformly deflected. In such designs the length of the passage between the vanes is equal to or greater than one and one-half times the pitch of the vanes. In wheels with cell-shaped blades, trajectories *o-o* from the end of one blade and *o'-o'* from the beginning of the next one form closed cells (Fig. 4, left). In modern turbines, such as the Kaplan hydraulic turbine, only relatively few blades are used, in order to reduce the wetted area and thus to keep down the friction losses. Such blades are said to be of the non-cell or wing type. The vanes do not overlap and their trajectories *o-o* and *o'-o'* do not form cells. (Fig 4, right.)

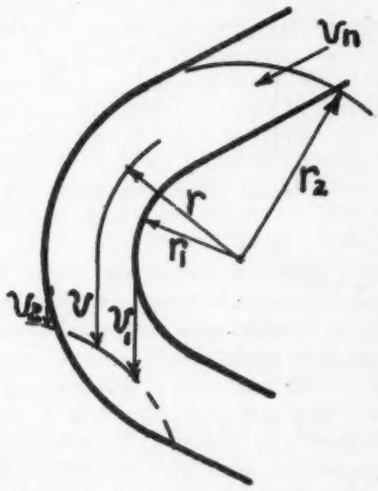


Fig. 3—Flow through on elbow

For a limited number, and especially for non-cell-type vanes, equations (4) to (7) are only approximately correct, because the deviation of the flow is not uniform, being greatest in the neighborhood of the vanes and less farther away from them. It is the average

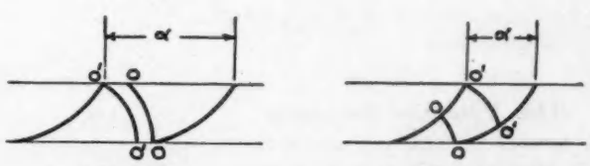


Fig. 4

Cell-shaped blades **Non-cell-shaped**

*Engineer, Bendix Aviation Corp.

deviation that measures the impulse and reaction, and, consequently, the torque. In other words, any blade wheel (impeller, turbine or guide wheel) functions as a system of identical aero- or hydro-foils, and the direction of the streamline of absolute velocity v_o leaving the blade wheel can be obtained by the addition of vectors of relative velocity w_o and circumferential velocity u_o only when there is an infinite number of blades and when the deflection of the fluid by the blades is uniform and complete. This not being the case, the blade angles of turbines and impellers are of necessity inaccurate, which affects their efficiency. Determination of the correct inlet and outlet angles for vanes is a more difficult problem than it is generally believed to be, and usually calls for some experimental work. This is also one of the reasons why guide wheels or diffusers are not more extensively used in compressors and pumps, for in many cases the guide vanes are found to be less efficient than expected, due to the fact that their entrance angles are incorrect.

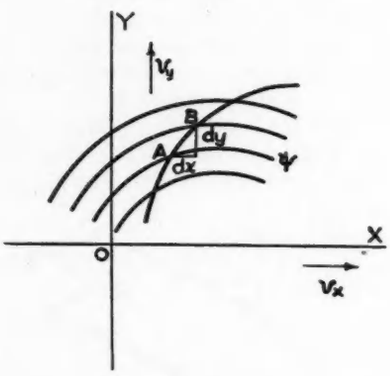


Fig. 5—Flow diagram

To be able to understand and improve blades for turbo mechanisms, one must know the theory of air foils and hydro foils, and of wing functions, for even if cell-shaped blades are used, their function is similar to that of a plurality of wings. From this point of view, any book on turbines or pumps that does not include anything on air foil theory must be considered out of date. For this reason I am giving here a short introduction to the theory of wings, which should be of help in solving problems that arise in the design of turbo-mechanisms.

The Potential Function

A concept that is very useful in the study of fluid motions is the potential flow, the velocity components of which at any point are given by the following two equations:

$$v_x = d\phi/dx \qquad (22)$$

$$v_y = d\phi/dy \qquad (23)$$

These equations apply to two-dimensional flow, for which the velocity component in a certain direction is obtained by differentiating the potential function in that direction. A flow which possesses such a velocity potential is called a potential flow. The potential function or velocity potential of a steady flow is expressed by

$$\phi = f(x, y) \qquad (24)$$

If we assign a definite value to ϕ, the equation $\phi = f(x, y)$ represents a line. The velocity potential does not change along this line and such lines therefore are called equipotential lines.

The Stream Function

Streamlines of a potential flow are always perpendicular to the equipotential lines. In other words, the equipotential lines "ϕ = constant" are normal to the fluid velocities. The stream function of a steady potential flow is given by

$$\psi = f(x, y) \qquad (25)$$

All lines ψ = constant build the streamlines. The stream function ψ of a point A represents the amount of fluid which flows between point A and the coordinate point of origin O. The distance of streamlines is inversely proportional to the flow velocity at a point. Whenever the streamline distance increases the velocity decreases and the pressure increases.

In Fig. 5, if point A is moved to B, the increase in the rate of flow, $d\psi_y$, parallel to the y-axis is equal to the flow through dy:

$$d\psi_y = v_x dy$$

and

$$d\psi_y/dy = v_x \qquad (26)$$

The decrease in the rate of flow parallel to the x-axis is

$$d\psi_x = -v_y dx$$

and

$$d\psi/dx = -v_y \qquad (27)$$

Finally, substituting from the equations for the potential flow, we get

$$v_x = \frac{\vartheta\phi}{\delta x} = \frac{\delta\psi}{\delta y} \qquad (28)$$

$$v_y = \frac{\vartheta\phi}{\delta y} = -\frac{\delta\psi}{\delta x} \qquad (29)$$

$$v = \sqrt{v_x^2 + v_y^2} = \sqrt{\frac{\delta\psi^2}{\delta x^2} + \frac{\delta\psi^2}{\delta y^2}}$$

$$= \frac{\delta\psi}{\sqrt{\delta x^2 + \delta y^2}}$$

$$v = \frac{\delta\psi}{\delta\sigma} \qquad (30)$$

where σ denotes a line in the direction of velocity v.

On the basis of these equations, the stream functions of a flow can be found, when the potential function is known, and vice versa, as follows:

Since

$$d\psi = \frac{d\psi}{dx}dx + \frac{d\psi}{dy}dy,$$

substituting from equations (28) and (29),

$$d\psi = -\frac{d\phi}{dy}dx + \frac{d\phi}{dx}dy \qquad (31)$$

Integrating this equation we get the value of ψ when the ϕ function is given. In a similar way

$$d\phi = \frac{d\psi}{dy}dx - \frac{d\psi}{dy}dy \qquad (32)$$

and the value of ϕ can be found by integrating this equation, when the ψ function is known.

Complex Stream Function

Finally, we can combine the potential and stream functions in a complex function—

$$\phi(x, y) + i\psi(x, y) = F(z) \qquad (33)$$

where $z = x + iy$ (34)

The complex stream functions are useful for "conformal transformations." By this method it is possible to find a potential flow around a body when the flow around another given shape is known. Usually the potential flow around a cylinder is taken as the basis for the calculation, and this is conformally transformed into a flow around an airfoil, an arc, a plate, etc.

Example I—Parallel Flow (Fig. 6.)

Let us consider a uniform flow parallel to the x-axis—

$$v_x = a \qquad v_y = O$$

Then the velocity potential (equation 22)

$$\phi = v_x dx = ax \qquad (35)$$

Equipotential lines (ϕ = constant) are parallel to the y-axis, and for the stream function

$$\frac{d\psi}{dy} = v_x = a$$

$$\psi = ay \qquad (36)$$

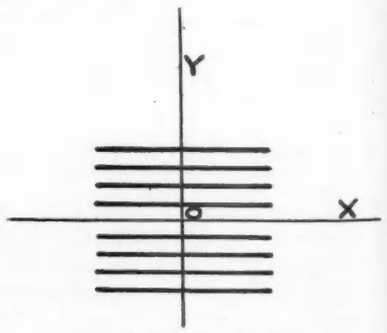


Fig. 6—Parallel flow

The streamlines (ψ = constant) are parallel to the x-axis. The complex stream function (eqution 36) then becomes

$$F(z) = ax + i\,ay \qquad (37)$$

Example II

We will now study the complex stream function

$$F(z) = a\,z^2 \qquad (38)$$

where $z = x + iy$; then

$$F(z) = a(x^2 - y^2) + 2iaxy \qquad (39)$$

$$F(z) = \phi(x,y) + i\psi(x,y) \text{ (Equ. 33)}$$

The streamlines

$$\psi = 2axy = \text{constant} \qquad (40)$$

as well as the equipotential curves

$$\phi = a(x^2 - y^2) = \text{constant} \qquad (41)$$

are hyperbolas.

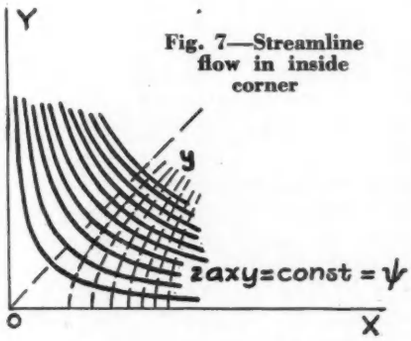


Fig. 7—Streamline flow in inside corner

From Fig. 7, which illustrates this streamline flow in a corner, we can see that for streamline flow the inside radius of an elbow should be larger than the oustide radius.

Example III—Flow Around a Cylinder

$$F(z) = V\left(z + \frac{R^2}{z}\right) \qquad (42)$$

Substituting $z = x + iy$ we get

$$\phi + i\psi = Vx + Viy + \frac{VR^2}{x + iy},$$

so that

$$\phi = Vx + \frac{VR^2x}{x^2 + y^2} \qquad (43)$$

and

$$\psi = -\frac{VR^2y}{x^2 + y^2} + Vy \qquad (44)$$

For the streamline function $\psi = O$ we get from (44), $y = O$ (x-axis), but also $x^2 + y^2 = R^2$ (cylinder of radius R). Then the velocity

$$v_x = \frac{d\phi}{dx} = V\left[1 + \frac{R^2(y^2 + x^2)}{(x^2 + y^2)^2}\right] \qquad (45)$$

and

$$v_y = \frac{d\phi}{dy} = -R^2V\frac{2yx}{(x^2 + y^2)^2} \qquad (46)$$

For $x = \infty$ and $y = \infty$, $v_x = V$, $v_y = O$, which means that for infinite dimensions the flow is parallel with the x-axis and has a velocity V.

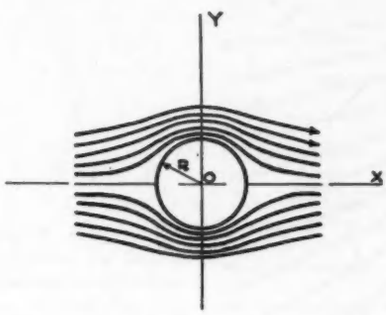


Fig. 8—Flow round a circular cylinder

This function represents flow around a circular cylinder of radius R (Fig. 8). The study of this flow is very important, notwithstanding the fact that the actual flow around a cylinder is quite different than the potential flow, owing to viscosity effects; it is important because it is useful for the study of flow around streamline bodies, which is similar to the potential flow despite the influence of viscosity.

In order to find the velocity at the periphery of the cylinder, let us substitute in equations (45) and (46)

$$x = R\cos\alpha \quad y = R\sin\alpha \quad v^2 = v_x^2 + v_y^2$$

This gives us

$$v = 2V\sin\alpha \qquad (47$$

(see Fig. 8).

The velocity on the x-axis is zero when $\alpha = O$ or 180°, and the velocity on the y-axis is equal to $2V$ when $\alpha = 90°$ or 270°. That is to say, the velocity on the periphery of the cylinder on the y-axis is $2V$.

When $\sin\alpha = \frac{1}{2}$, that is, when $\alpha = 30°$, we get $v = V$; that is, at a point where the inclination is 30 deg., the velocity and pressure are equal to the velocity and pressure of undisturbed flow.

Example IV—Circulatory Flow

$$F(z) = bilg_n z = bilg_n(x + iy) \qquad (48)$$

Substituting $x + iy = re^{i\delta}$,

$$lg_n z = lg_n r + i\delta \qquad (49)$$

and

$$\phi + i\psi = (lg_n r + i\delta)\,bi$$

$$\phi + i\psi = bilg_n r - b\delta \qquad (50)$$

$$\phi = -b\delta \qquad (51)$$

$$\psi = blg_n r \qquad (52)$$

When ψ = constant, $r = e^{\psi/b}$ = constant

Streamlines are circles (Fig. 9).

From the fact that $v = d\phi/d\delta$ (equation 30), and because

$$d\sigma = rd\delta \qquad (53)$$

$$v = d\phi/rd\delta$$

$$v = -b/r \text{ or}$$

$$vr = b = \text{constant} \qquad (54)$$

which is the known equation for the free vortex (equ. 16). Usually, however, we take the circulation or vorticity as a line integral

$$\Gamma = \int v_\sigma\,d\delta \qquad (55)$$

where v^σ is the component of the velocity v in the direction of σ. For a circulatory movement v_σ = constant, substituting from equation (53)

$$\Gamma = \int_o^{\circ} v\sigma rd\delta = v\sigma 2\pi r \qquad (56)$$

and

$$v = \Gamma/2\pi r \qquad (57)$$

Example V—Flow Around Cylinder With Circulation

From flows III and IV we can obtain a new flow V by simply adding the functions F, ϕ and ψ. For instance, let

$$F(z) = V\left(z + \frac{R^2}{z}\right) + bilg_n z \qquad (58)$$

To draw the streamline of this flow we proceed as follows: We first draw the flow around the cylinder (Fig. 8), then the circulating flow (Fig. 9) on a separate transparent paper, then lay the transparent paper on the first paper so the center of Fig. 9 is exactly on the center of Fig. 8, and draw the diagonals. The streamlines will be similar to those which are drawn in Fig. 10 for a small cylinder. From Example III the velocity at the periphery of the cylinder

$$v_1 = 2V\sin\alpha \text{ (equ. 47)}$$

From Example IV we get the circulatory velocity

$$v_2 = \Gamma/2\pi R \text{ (equ. 57)}$$

The total velocity is

$$v = v_1 + v_2 = 2V\sin\alpha + \frac{\Gamma}{2\pi R} \qquad (59)$$

According to Bernoulli (equ. 14), the total head is equal to the sum of the pressure head and the velocity head—

$$h = p/k + v^2/2g$$

$$p/k = h - [2V\sin\alpha - \Gamma/2\pi R]^2/\,2g \qquad (60)$$

The lift forces exerted on a unit length of the cylinder may be determined to act on an elementary area

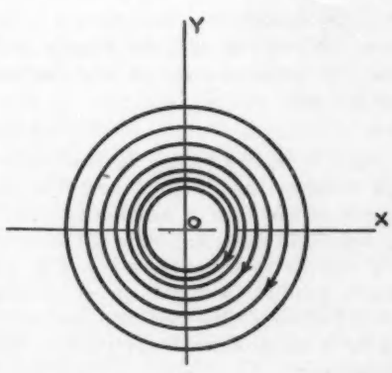


Fig. 9—Circulation flow

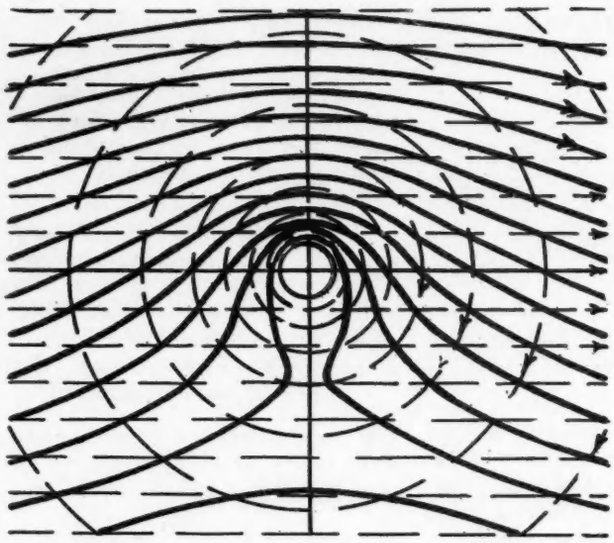


Fig. 10 — Flow round a cylinder with circulation superposed

$dA = R\,d\phi$. Then the pressure is $p.dA$, and the vertical component of this pressure (Fig. 11) is

$$dp_v = p\,(dA)\sin\phi = p\sin\phi\,R\,d\phi$$

The total lift force l can be obtained by integrating p completely around the cylinder—

$$l = -R\int_0^{2\pi} p\sin\varphi\,d\varphi$$

Substituting from (60), we get

$$l/k = -R/2g\left[-4V^2\int\sin^3\varphi\,d\varphi - \frac{2V}{\pi R}\Gamma\int\sin^2\varphi d\varphi - \frac{\Gamma^2}{4\pi^2R^2}\int\sin\varphi d\varphi\right]_o^{2\pi}$$

The first and third terms integrate to zero; the middle term simplifies and becomes

$$\int_o^{2\pi}\sin^2\varphi d\varphi = \frac{1}{2}\left[\Big/_o^{2\pi}\varphi - \Big/_o^{2\pi}\sin\varphi\cos\varphi\right]$$

Then the lift per unit of length is

$$l = \rho \times R/2 \times 2V/\pi R \times \Gamma\pi$$

Finally, the lift per unit of length

$$l = \rho V\Gamma \qquad (61)$$

Where ρ denotes the mass density of the fluid. When the cylinder length is b, the lift perpendicular to the original undisturbed flow

$$L = \rho V\Gamma b \qquad (62)$$

This is known as the Kutta-Joukovski theorem and shows how lift depends on the rate of circulation Γ.

Aero-hydrofoils are wing-shaped bodies, similar to those shown in Fig. 11, which produce a lift L perpendicular to the stream direction and are acted on by a small drag D parallel to that direction.

Experiments on aero-hydrofoils show that the lift and drag are given by the following equations:

$$L = C_L\frac{1}{2}\rho FV^2 \qquad (63)$$

$$D = C_D\frac{1}{2}\rho FV^2 \qquad (64)$$

Experience also shows that the distance of the center of pressure P from the leading edge is proportional to the chord C. There is always an angle of attack α which gives no lift. The coefficients of lift C_L and of drag C_d are

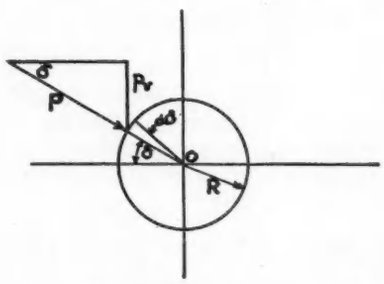


Fig. 11—Components of lift forces

determined by experiment, and the wing area is found from the equation $F = bc$ (length b of wing times chord c, Fig. 12). The distance of the center of pressure from the front edge of the wing is denoted by e. The coefficient of lift is

$$C_L = dC_L/d\alpha(\alpha + \alpha_o) \qquad (65)$$

where $dC_L/d\alpha$ is the slope of the lift curve, α is the angle attack from the chord, and α_o is the angle of attack of zero lift.

It can be proved mathematically, by the potential-flow theory, that a flat plate inclined at a small angle to the direction of the flow has a lift L many times greater than its drag. Theoretically,

$$C_L = 2\pi\sin\alpha \qquad (66)$$

and the center of pressure is therefore at a distance $C/4$ from the leading edge.

$$e = C/4 \qquad (67)$$

This is of special importance in connection with turbo transmissions, where pivoted but practically straight auxiliary vanes must be used, because the entrance angles of the fluid are too variable. A better L/D ratio is obtained by giving the vane a slight curvature or camber. Theoretically, for small angles,

$$C_L = 2\pi\,(2f/c + \alpha) \qquad (68)$$

where f is the height of the camber (Fig. 13).

Still larger L/D ratios can be obtained by using regular airfoils as employed on airplanes.

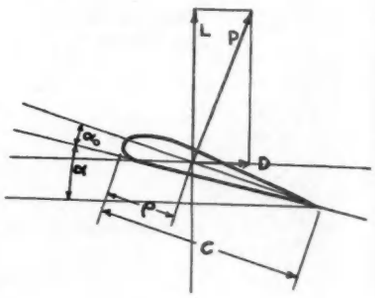


Fig. 12—Forces on wing

Superposition of Flow Systems

Whenever a fluid has two or more velocities in different directions at the same time, the resultant flow can be found by adding velocity vectors, according to the parallelogram law. Therefore, by simply drawing diagonals from two flow systems we can obtain the resultant flow. Fig. 14 shows resultant streamlines of a sink (—) and a source (+) of equal strength, drawn by the method of diagonals. When enough streamlines are drawn we find that the resultant streamlines are circles. The dotted lines are the original streamlines of the source and the sink.

In the case of blade wheels (turbine

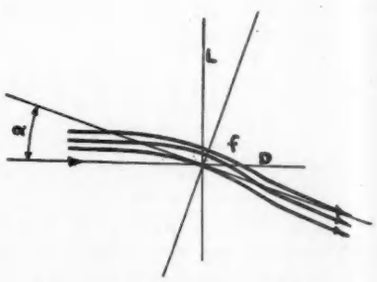


Fig. 13—Circular arc

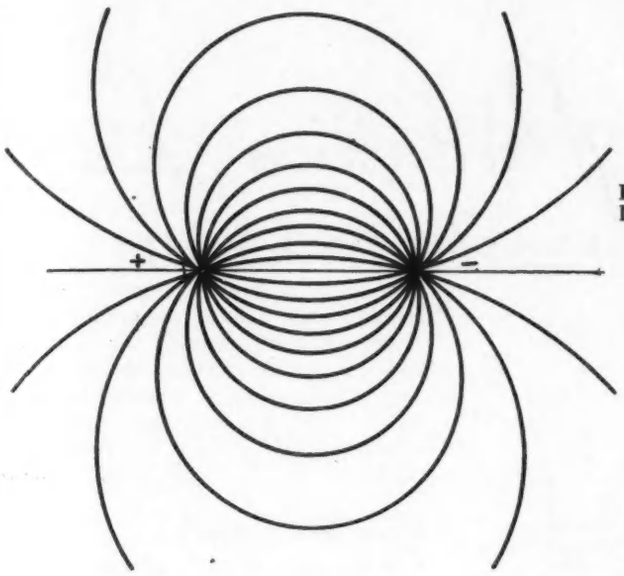


Fig. 14—Streamlining of a sink and a source

The smaller the ratio d/c, the smaller the coefficient C_l, and vice versa. Assuming that for a ratio $d/c = \infty$, the coefficient C_l is equal to 100 per cent; then for $d/c = 2$ we obtain approximately 85 per cent, for $d/c = 1$, 59 per cent, and for $d/c = 0.75$, 44 per cent.

When calculating the blade wheels of turbo transmissions, the dimensions are first determined in the old way from equations (4), (5), (6) and (7),

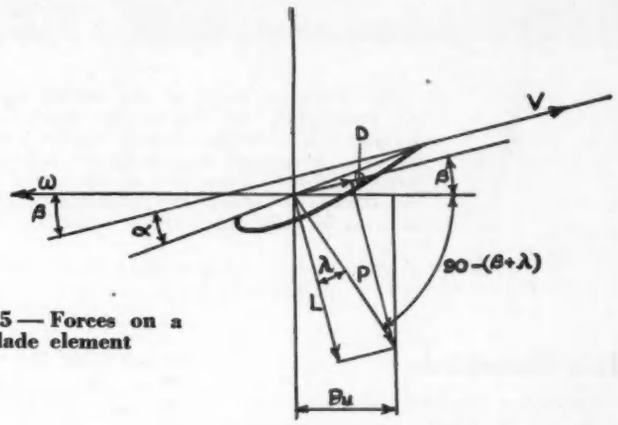


Fig. 15 — Forces on a blade element

runners or impellers), each blade can be considered as a wing, and for the case of the impeller the force on each blade can be calculated from Fig. 15. Lift L and drag D produce a resultant force P on each blade which makes an angle $[90 - (\beta + \lambda)]$ with the circumferential velocity u. The circumferential component of this force is

$$P_u = P \cos [90-(\beta+\lambda)] = P \sin (\beta+\lambda) \quad (69)$$

and the energy necessary to move the blade is

$$e_1 = Pu \sin (\beta + \lambda) \quad (70)$$

Furthermore

$$P = L/\cos \lambda \quad (71)$$

and substituting for L from equation (63)

$$P = 1/2\rho V^2 F C_L/\cos \lambda \quad (72)$$

This value substituted in equation (70) gives the energy expended on one blade—

$$e_1 = \rho V^2 F_L C \sin (\beta + \lambda)/2 \cos \lambda \quad (73)$$

If the number of impeller blades is q, the total energy imparted to the impeller is

$$e = qe_1 \quad (74)$$

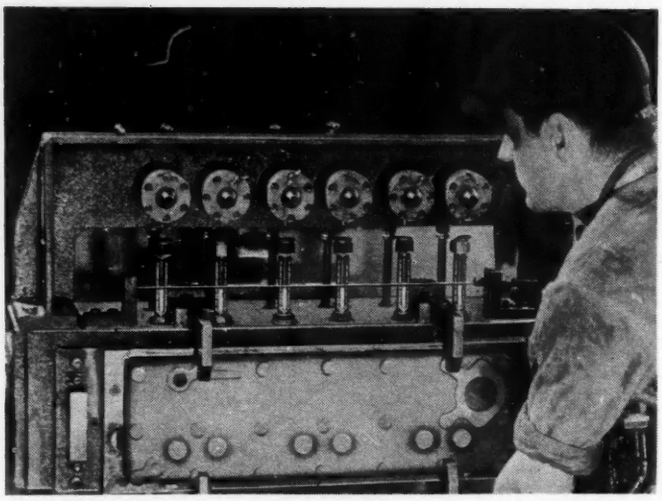
where e_1 can be figured from equation (73), but the lift coefficient C_l is somewhat smaller than the corresponding coefficient C_L for a single wing. The value of C_l depends on the ratio of the pitch d to the chord c.

and corrections are then made for discharge angles and velocities, in accordance with the wing theory, using characteristics of known aero- or hydrofoils. Lift and drag coefficients for different angles of attack α are known for a large number of aerofoils; for hydrofoils these experimental data are lacking, but we can assume that the life and drag coefficients for liquids are not greatly different from those for air, provided the Reynolds numbers have similar values.

German Fuel Regulations Revised

A NUMBER of changes have been made recently in the regulations requiring German manufacturers of motor gasoline to mix it with alcohol. By law, each manufacturer of such fuel is compelled to take from the Reich Alcohol Monopoly 10 per cent of his sales of motor fuel in alcohol. The alcohol supplied for this purpose by the Monopoly will hereafter contain one part in three (instead of one part in six) of methanol (wood alcohol).

The percentage of this mixture in motor fuel has been increased from 11 to 13-16, the rest consisting of gasoline. The gasoline may also be mixed with up to 10 per cent of benzol. Mixtures of gasoline containing more than 10 and less than 30 per cent of benzol can be sold only when a special permit has been obtained. Gasoline without an alcohol addition can be sold only for aviation purposes and then only if a certificate has been issued by the Minister for Air attesting the need for such fuel. Mixtures of gasoline and more than 30 per cent benzol can be sold as gasoline-benzol blends and do not require any alcohol addition. However, firms preparing such blends, while they do not have to take the 10 per cent alcohol corresponding to their production, are required to pay for the exemption at the rate of 12.50 marks per 100 liters (about 19 cents per gallon) and the alcohol thus set free is furnished to the manufacturers of gasoline-alcohol blends, who, while required by law to take only 10 per cent of their production, naturally require more, as they can sell only blends containing from 13 to 16 per cent of alcohol.



The device is used at the Dodge plant to check the uniformity of the oddly shaped combustion chambers in cylinder heads, which are filled with precisely measured quantities of colored water, so that a uniform excess rises in calibrated glass gauges. The degree to which the combustion chambers are uniform in cubic capacity is indicated by the water level.

Production Lines

Job Standards

Employer-employe relations are so much a part of the thinking of management today that two of the technical papers on the program of the AFA convention in Milwaukee dealt with various aspects of the problem. Bertram Miller, supervisor, planning and wage dept., General Electric Co., presented a study, entitled, "Job Evaluation"; while H. C. Robson, operating supt., Link-Belt Co., discussed, "Time-Motion Study and Job Standardization." Both dealt with a similar situation which consists in an answer to the following questions uppermost in the mind of the employe—Is my rate fair in relation to the other jobs in my department? Is my rate fair in comparison with the rate in community industries? While there is little room here to go into the details, suffice it to say that both men have produced discussion and procedures of interest to the management of any manufacturing plant. We urge you to get these papers and study them at your leisure.

Oil Burner

Several days back we drove a car fitted with a novel fuel oil burner for gasoline engines. This unit seems to have IT considering the remarkable showing on this car. It starts easily on a priming charge of gasoline; it idles at low speed; and perks along smoothly at top speeds. A feature of the device is a spark plug for heating and vaporizing the fuel oil, thus incorporating the elements of a cracking still. The manufacturer claims that the unit will burn any of the furnace oils now on the market.

Zein Plastics

Pendleton Dudley, executive secretary, Corn Industries Research Foundation, presented an interesting discussion on Plastics from corn at the Third Dearborn Conference recently. Zein protein, the ingredient in corn that is valuable as a molded plastic base, is available in great profusion, so much so in fact that if all other sources of supply were suddenly wiped out, the available protein from about three months' grind would take care of all the plastics demand for a year. For this reason, the plastics field, although large in itself, would not seriously affect the fortunes of the corn products industry one way or another. According to the author, the volume of plastics produced today is about one hundred million (100,000,000) pounds annually. Thus, although Zein is available for the plastics field, its use is not a large factor in the improvement of the farm problem.

Real Chance

Fred Zeder addressed a group of newspaper men the other day on a subject very close to his heart—the Chrysler Institute. To Fred, the Institute represents a sincere effort on the part of Chrysler to aid technical men in finding themselves and its product ultimately is absorbed into and becomes a vital part of the organization. From what we know of the Institute and its people, we can honestly say that it represents a remarkable work on the part of a purely industrial enterprise and gives a marvelous opportunity to the technically trained

Poor Economics

We noted recently the papers presented at the Farm Chemurgic Council meeting on the subject of Agrol (alcohol-gasoline) motor fuels. Granting all the favorable conditions, there remains an almost insuperable economic hurdle—namely the fluctuations in the price of corn. The last report gave the price of Agrol Fluid as based on corn at 60 cents a bushel. However, even while the report was being read, corn futures were quoted around $1.26. Some people fear that the introduction of so large a variable may create a condition of instability in the domestic power fuel situation.

Eye Appeal

Piecing together some fragments of conversation here and there, we have the impression that body styling will trend somewhat in the direction of that well known front drive car. It is quite likely that roofs will come still closer to the ground and that hood lines will drop correspondingly. This is not a prediction but it seems to be in the cards.

Economic Recovery

Readjustments Required for Recovery is the thought-provoking title of a brochure issued by Public Affairs Committee. It represents the digest of a wide economic study of the situation in the U. S.; and what may be done about it. To us the keynote is that *More Work* and not shorter hours is the pointed answer. The investigators ask—Do we want more leisure or do we want more of the good things. It is estimated that if we are to regain the 1929 level within five years, our durable goods industries must turn out approximately 33 billion dollars' worth of goods each year from 1937 to 1941. To do this would demand the employment of eight to nine million

(Turn to page 951, please)

Aerotype Carburetor Reduces Effect of Centrifugal Force on Turns

A NEW duplex downdraft carburetor, called the Aerotype because of its derivation from the Stromberg aircraft-engine carburetor, has been developed by the Stromberg Carburetor Division of Bendix Aviation Corp. and is standard equipment on this year's Buick, Cadillac and Chrysler models.

One of the most interesting features of the new design is the dual float and jet-well arrangement, illustrated in Figs. 3 and 4. It has been the practice recently to provide about 25 per cent more air-passage area in a dual carburetor than in a single carburetor intended for the same engine; hence the metering suction is considerably lower, and in consequence the fuel delivery is much more sensitive to changes in the float-chamber fuel level. The most marked changes in the effective fuel level are due to lateral inclinations, when (1) the car stands on one side of a crowned road, (2) the engine oscillates sidewise on its flexible mounting, (3) the car leans outward on a sharp turn, or (4) the fuel surges sharply toward the outside on a turn.

All of these except (1) are temporary in character, but (3) and (4) combine, the outside of the carburetor tilting down on a curve while the fuel level rises and sometimes changes its normal position relative to the carburetor by as much as 40 deg. It will be noted that with the carburetor remaining level, centrifugal displacements are similar and equivalent in effect to lateral tilting of the carburetor while standing still.

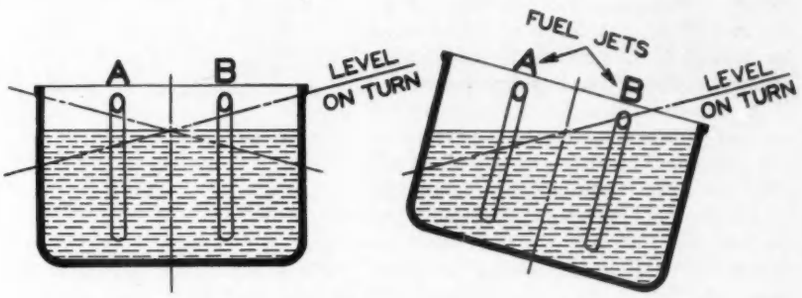


Fig. 2—Conventional fuel chamber with the car on a level and tilted over respectively

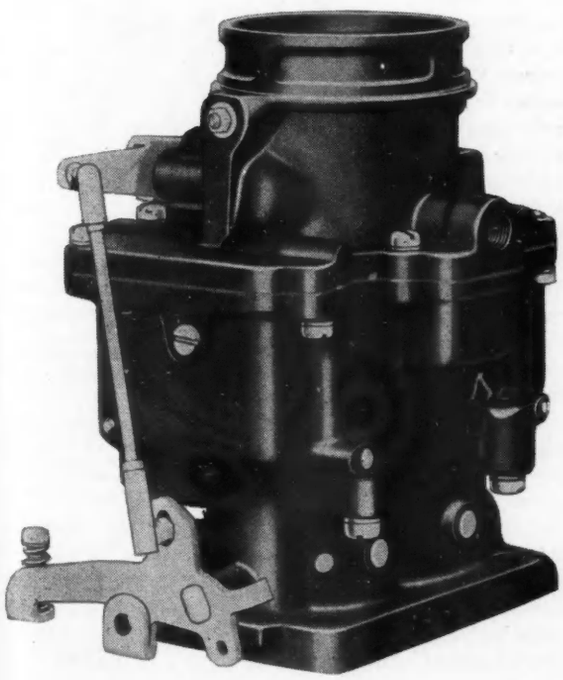


Fig. 1 — New Stromberg Aerotype carburetor

Fig. 2 shows how any given change in the level of a single fuel chamber affects the level relation of two adjacent jets A and B. With dual carburetors of earlier design it is said to be quite common, because of this effect, to have the engine cut out on a sharp turn made in high gear at below 15 m.p.h., the inner jet delivering too lean a mixture and the outer jet a mixture that is too rich. Fig. 2 shows that this is the equivalent of tilting the carburetor when it is not under centrifugal force.

Fig. 3 shows how the effect of static and centrifugal temporary displacements are minimized by a system of chambers. It will be seen that the carburetor reservoir has been divided into four chambers 1, 2, 3 and 4, of which the two inner ones, 2 and 3, are wells from which the jets are fed, while chambers 1 and 4 contain float members that connect to a single float valve (see Fig. 4). When temporarily subjected to either gravitational or centrifugal displacing forces, as in Fig. 3, the fuel tends to lower in chamber 2 and to rise in chamber 3; however, this

same displacement has raised the level in chamber 1 and lowered it in chamber 4, so that for several seconds the fuel in 1 tends to flow into 2, and that in 3 tends to flow into 4, and the well levels are temporarily maintained about as shown in Fig. 4—long enough to make the average low-speed turn. The same baffle system maintains the level in jet-well chambers 2 and 3 nearly uniform under conditions which tend to make the fuel surge from side to side, as with the engine rocking on its flexible mounting, or in traveling over a rough road; and this has been found to contribute not only to a reduction in the fuel consumption, but also to increased life of the float mechanism.

As shown in Fig. 4, the floats are arranged symmetrically with respect to the jets also in a fore-and-aft direction, with the usual eight-cylinder mounting, and the fuel chamber surrounds the barrels, so that the car can stand on practically any grade without flooding from the jets. Also, the engine will not stall when the car is brought to a quick stop by the brakes from either forward or reverse motion. This float arrangement is equally effective when the carburetor is mounted on a six-cylinder engine, each barrel feeding one group of three cylinders at one end.

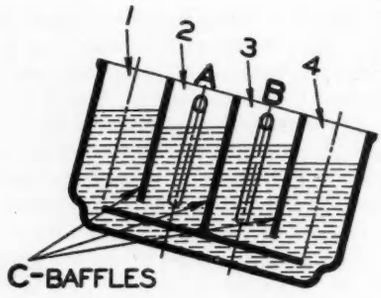


Fig. 3—Diagram of levels in Aerotype fuel chambers just after a lateral tilt

A group of novel features in the design of the jets and fuel chambers takes account of the high volatility of the newer gasolines. While the introduction of these lighter winter fuels has made cold-weather motor-car operation much more convenient, it has certainly caused the carburetor engineer many difficulties. Few people realize that the carburetor body often reaches a temperature some 50 deg. Fahr. above the 10-per cent boiling point of the gasoline used and that under such conditions the whole upper portion of the gasoline chamber is in a state of violent ebullition, gasoline vapor being evolved at a high rate. Further, the carburetor usually reaches its highest temperature a few minutes after stopping from a high speed when —without the fan blast and the intake air to cool the intake system — the stored-up exhaust heat creeps up from the exhaust-heated hot-spot, through the intake-manifold flange, and into the carburetor.

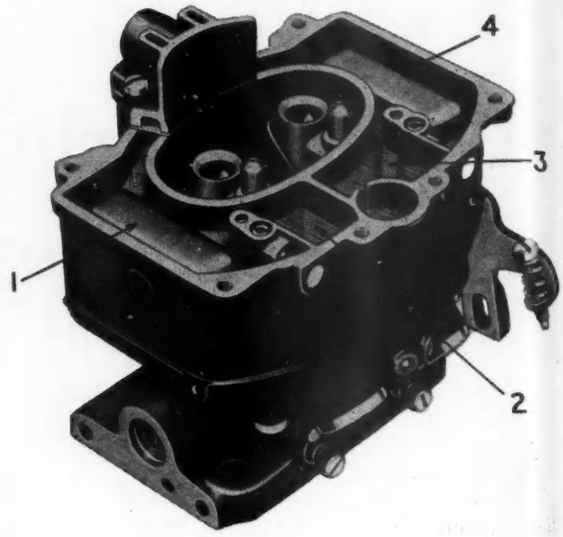


Fig. 4 — Open view of lower half of carburetor, showing float and jet-well arrangement

Stromberg engineers have succeeded in developing a jet construction in which the metering is not disturbed even though the temperature of the carburetor body is much higher than the boiling point of the fuel in the carburetor; in other words, when the fuel is boiling vigorously in the float chamber. Also, *percolation*, or boiling from the float chamber into the intake following stopping after a hard run, has been eliminated. Part of the construction employed to overcome this is shown in the sectional drawing in Fig. 5. It will be noticed, first, that the metering jet 9 is located to draw centrally from a large free body of fuel, undisturbed by the bubbles which form near the walls during boiling. Next, the jet boss has been formed with a free fuel space around it, to prevent heat from being conducted through the lower flange and body of the carburetor. Particular attention is directed to the jet body construction. Finally, the fuel passages have been designed so that vapor bubbles are separated and vented out of the main fuel flow, by utilization of the laws of surface tension.

In addition to the steps just described, a number of precautions have been taken in the design to insure free venting of fuel vapor while there is violent boiling in the float chamber, and maintenance of normal undisturbed pressure above the fuel, without escape of liquid.

Otherwise this design employs the well-known Stromberg features such as the double venturii, the air-bled jet, and the economizer or power jet brought in when full power is demanded, thus allowing a lean main jet setting for ordinary part-throttle driving.

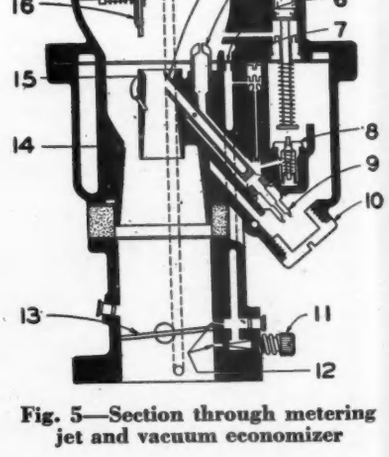


Fig. 5—Section through metering jet and vacuum economizer

1. Choke Valve
2. Vacuum Channel
3. Main Discharge Jet
4. High Speed Bleeder
5. Economizer Vacuum Piston
6. Idle Air Bleeder
7. Idle Tube
8. Economizer By-Pass Jet
9. Main Metering Jet
10. Main Discharge Jet Plug
11. Idle Needle Valve
12. Idle Discharge Holes
13. Throttle Valve
14. Primary Venturi
15. Auxiliary Venturi
16. Choke Relief Valve

A prolonged-action, throttle-operated, accelerating pump is used. There is a preloaded spring between the operating rod and the pump piston, so that the first part of the stroke following a throttle movement is generated by spring pressure, thus making it impossible to momentarily overload the engine through too great an accelerating charge rate. In addition, blow-off valves are fitted which allow some of the accelerating charge to escape when the throttle is opened quickly.

The idling system has been made short and direct, with passages of large capacity so that occasional generation of vapor in them will not reduce the metering suctions. In addition to the trouble from boiling of high-volatility winter gasolines, trouble has been experienced also from the formation of ice in the throttle and idling jets during the few minutes just after starting, with the external air at about 40 deg. Fahr. To prevent this, a thin gasket is used between the carburetor flange and the intake manifold, to allow heat to flow to the carburetor as quickly as possible after starting. A thick asbestos-compound gasket is then used to separate the float-chamber body from the throttle-barrel unit. This construction, though it alleviates the ice difficulty, makes it necessary to use large idling passages in the unprotected throttle barrel, as when the engine is hot, most of the fuel passes through these channels in the vaporized state.

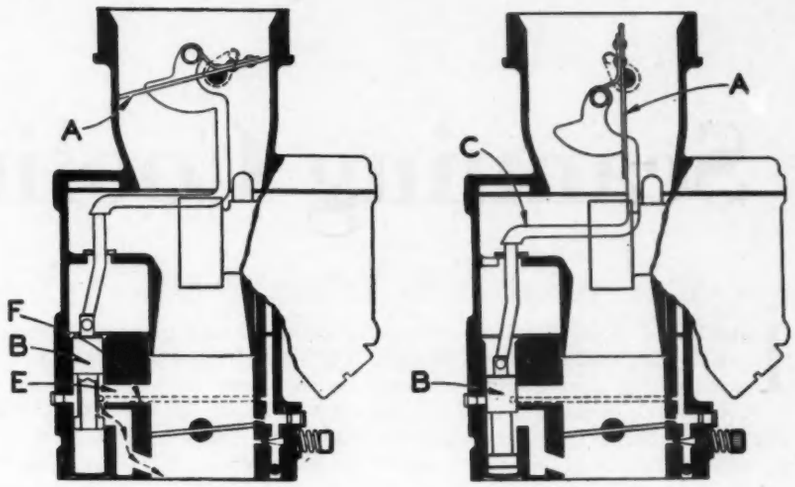


Fig. 6—Piston-type fast-idle construction

Automatic Choke

Several different types of Stromberg automatic choke are furnished, at the option of the car manufacturer. All function substantially as follows: (1) During cranking the automatic choke increases the throttle opening beyond that corresponding to normal idling and greatly enriches the mixture; (2) To keep the engine firing just after starting the increased throttle opening is maintained, but the mixture proportion is now changed to moderately rich; (3) As the engine warms up and its friction decreases, the throttle opening is reduced to the normal for idling; (4) During the warming-up driving period the mixture is very slightly enriched at part throttle but considerably enriched at full throttle; (5) As the engine approaches its minimum normal temperature the choke is opened fully, which gives a normal mixture proportion.

It will be noted that the above requirements involve a coordination of throttle opening, mixture enrichment, and control according to engine load, which last is proportional to the manifold depression. Accordingly, Stromberg automatic chokes employ a choke valve with shaft off center, so that it responds to suction; a bi-metal thermostat spring, responsive either to engine temperature or a parallel temperature change, which opposes the opening of the choke valve as its temperature is lowered; and a "vacuum kick" piston, responsive to the depression beyond the throttle, which tends to help open the choke. While cranking, there is very little depression beyond the throttle, and the thermostat spring is set with enough tension to insure a very rich cranking mixture at low temperatures. As soon as the engine starts to fire and speeds up, the resulting depression beyond the throttle operates on the "vacuum kick" piston to partially overcome the thermostat-spring effort, thus decreasing the mixture enrichment. As the engine warms up, the thermostat tension becomes less, decreasing the mixture enrichment; but all through this period, if the throttle be opened wide at low speed, the release of manifold depression tends to give a slightly richer mixture than at partial throttle opening. Finally, of course, the thermostat warms up enough to hold the choke valve wide open without the help of the "vacuum kick" piston.

A material improvement in control of the mixture during this warming up period has been obtained in the "piston-type" fast idle, by making the "vacuum kick" piston the means of augmenting the throttle opening, and by having its motion also uncover an auxiliary "fast idle" fuel jet. As mentioned at the beginning of this article, in modern carburetor practice the metering suctions are quite low, which means that accurate control of the mixture by choke position is extraordinarily difficult, the scale of accuracy needed being of the order of a few thousandths of a pound-inch torque.

When the Stromberg "piston type" fast idle is fitted, the thermostat is adjusted so that during the warming-up period, the choke is so nearly open that its own enriching effect is negligible; a predetermined fast idle and mixture enrichment being obtained instead by air and fuel orifices uncovered by the fast-idle piston. This gives a powerful starting charge, along with a smooth warming-up mixture, not unduly rich; all without being sensitive to small variations in choke setting that are not controllable in production.

Choke Control By Exhaust and Electric Heat

One interesting variation of the Stromberg automatic choke constructions is in the location of the thermostat elements. These were originally mounted on the carburetor in a location subject to heat conduction from the exhaust manifold; or, alternately, were heated by a tube bringing hot air from the exhaust manifold. In other cases they have been mounted adjacent to the exhaust manifold. Another neat, compact and very satisfactory approximation to ideal requirements has been obtained by mounting the thermostat spring directly on the end of the choke shaft and subjecting it to the heat of a small electric coil, drawing 0.9 to 1.1 ampere, and connected in series with the ignition switch. In this way, the choke valve action depends on both the initial hood temperature and on the time elapsed since the switch was turned on. This has proven quite satisfactory, and is particularly effective in getting the choke to open quickly, as is desirable with the very light gasolines.

Scanning Cooling Systems*

ILLUSTRATING the high rate at which the radiators of modern automobiles must dispose of heat, L. P. Saunders, director of engineering, Harrison Radiator Corp., states that a car with an engine of 350 cu. in. piston displacement when traveling at 60 m.p.h. generates enough waste heat to warm a seven-room house in zero weather. Following is an abstract of Mr. Saunders' paper, which bore the title "Anticipating Cooling Requirements."

One of the difficulties encountered in disposing of the waste heat of the engine results from the great difference in the heat capacities of the media contacting the walls of the radiator core on opposite sides. Air is only about 1/800 as dense as water, and has a specific heat less than one-fourth as large, hence its heat capacity is less than 1/3200 that of an equal volume of water. For every pint of water entering the radiator, roughly 66 cu. ft. of air must pass through it.

The capacity of radiator cores can be increased by increasing the area exposed to the air (as by providing a tube with very closely spaced, deep fins), but this, of necessity, adds to the weight per unit of volume and to the resistance to air flow through the radiator. Resistance to air flow is made up of two items, viz., friction and inertia. At any given air velocity each of the two requires a certain pressure to overcome it, and the sum of the two is known as the total or dynamic pressure. At 60 m.p.h. the dynamic pressure does not exceed 1 oz. per sq. in., or 1.73 in. of water column, and as the frictional resistance to air flow through the core is about 1.25 in. of water column, there is only ½ in. left for the velocity pressure, which overcomes the inertia of the air.

Among the materials used for radiator cores (including the solders), are copper, aluminum, brass, zinc, tin, nickel, steel, lead and everdur. Their heat conductivities differ greatly (from copper down in the order in which the materials are listed), pure copper having more than 20 times the heat conductivity of everdur. However, the heat conductivity of the core has little effect on the capacity of a radiator core, and it has been found that a core made entirely of everdur has 84 per cent the capacity of an all-copper core. Different solders employed in the manufacture of radiator cores were found to have no influence on the heat flow.

With tubular cores there is not much difference in the heat-dissipating capacity at high speeds whether the tubes are staggered or in line, but the power consumed in forcing air through the core is notably greater with staggered tubes. Tests were made with various types of streamlined and semi-streamlined tubes (designed to reduce the "air horsepower" required), but the maximum gain did not exceed 2 per cent. Some types of tube-and-fin cores lose capacity with age, and it has been found that this is due to the fins coming close on the tubes.

Present-day radiator cores hold about 0.5 oz. of water per sq. ft. of exposed surface. Assuming that there is 2 sq. ft. of exposed surface per hp. devel-

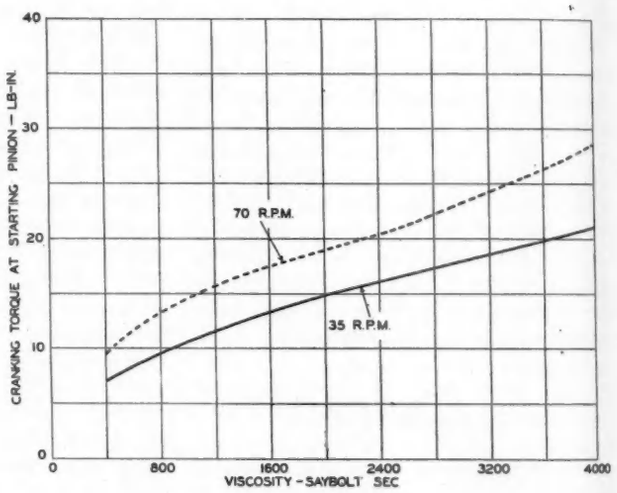


Fig. 2—Cranking torque vs. crankcase-oil viscosity.

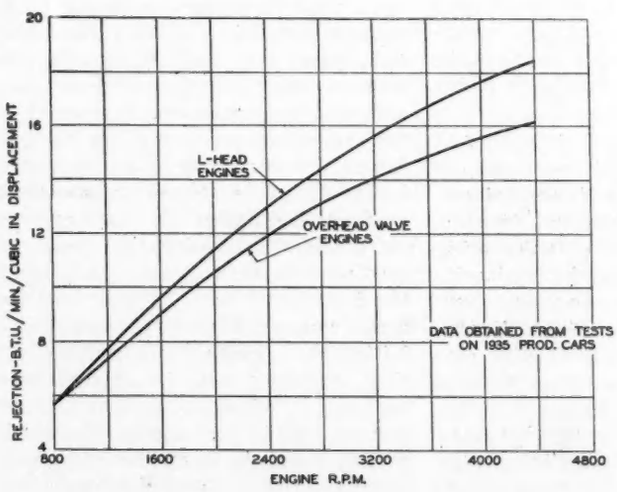


Fig. 1—Heat rejected to water jacket as a function of the speed, for L-head and valve-in-head engines respectively.

*A paper read before the Buffalo Section of the S.A.E.

Shows that—

Grilles retard radiator efficiency; Fans lower temperature as much as 20 deg.; Superchargers induce no added heat.

oped, this makes one ounce of water in the core for every engine horsepower.

A good test for the cooling characteristics of a cylinder-block design is to measure the amount of liquid discharged from the jacket upon shutting down after a hard run. The smaller this discharge, the better the design (from the cooling standpoint). It is suggested that this test be made also with a typical high-strength anti-freeze solution, such as a 50-50 alcohol solution, which has a much lower volumetric heat capacity than water.

Engines with properly designed cooling systems, without undue restrictions in the circuit, will show a rise in temperature of not more than 20 deg. when shutting down after a hard run. Valve-in-head engines, as a rule, throw less heat into the jacket per horsepower developed, but it is often difficult to effect a satisfactory distribution of the cooling water in their heads. Valve guides that are too long on the head side act merely as a heat-storage device and feed heat back into the valve head after the engine has been stopped. In addition, the greater distortion of the valve guide may pull the valve out of line with its seat, and thus cause leakage. Under maximum-load conditions, the head of a satisfactorily cooled exhaust valve is cherry red, with a rim dark. Exhaust valve temperatures, if excessive, often can be reduced by a change in the design or the location of the exhaust manifold, or by changes in the muffler reducing its back pressure.

A change in jacket temperature has little effect on the temperature of the exhaust gas, an increase of 50 deg. in the former resulting in not more than 10 deg. rise in the latter at around 1500 deg.

As the car speed increases, the capacity of the radiator to dissipate heat, as well as the rate at which heat is supplied to the radiator, increases, but the temperature of the water at the radiator inlet rises. The rate of rise should preferably be limited to ¾ deg. F. per mile per hour. The radiator temperature, of course, is affected by the richness of the mixture, and in a recent test, by changing the mixture ratio and thereby decreasing the fuel mileage from 9 to 6 m.p.g. at 60 m.p.h., the radiator temperature was increased 6 deg.

Mr. Saunders can see no advantage in the often-proposed plan of disengaging the fan at higher driving speeds. The fan, he says, performs a dual function, drawing air through the radiator core and forcing it out of the engine compartment. He found as much as 20 deg. difference in the radiator-inlet temperature at 60 m.p.h. with and without the fan.

The capacity of radiators has been materially reduced by the installation of grilles in front of them. Where formerly at car speeds of 60 m.p.h. the air velocity through the radiator was between 2600 and 2800 ft. p. m., at present it is only 2000 to 2200 ft. p. m. Naturally, the temperature rise of the air on passing through the radiator is increased, and the over-all load on the cooling system also is slightly increased, because less heat is abstracted from the engine block by the more highly heated air passing over it.

Mr. Saunders pointed out that, contrary to general opinion, if the water of a car boils while climbing a hill in high, it is possible to stop the boiling by changing to second gear, provided the car speed is not increased. This is due to the more rapid circulation of the water and the increased air velocity with the car in second gear. However, if the change is made from high to second and the throttle kept wide open, the boiling will be aggravated.

Operating with a supercharge of 10 lb. per sq. in. manifold pressure, the demand on the cooling system is no greater than with atmospheric induction. While under accelerating and hill-climbing conditions the power gen-

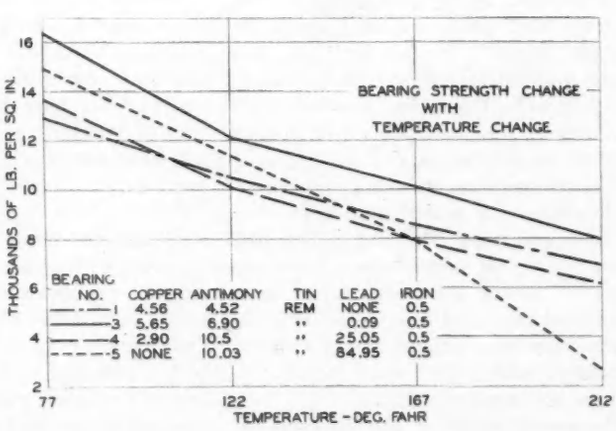


Fig. 3—Loss of strength of bearing metals with increase in temperature.

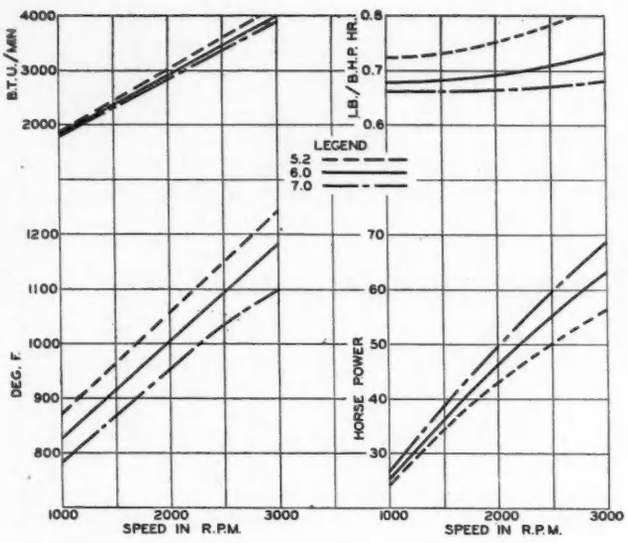


Fig. 4 — Effects of compression ratio on heat loss to cooling water, specific fuel consumption, exhaust temperature and engine output.

erated will be considerably greater with the supercharger, the time required to reach a given speed or to climb a hill will be proportionately less and there will be no greater temperature rise than with atmospheric induction.

In making a test of water loss from a radiator, it is essential that the water be first brought to the boiling point, so as to remove all of the free oxygen from it. The water loss is determined by attaching a rubber tube to the bottom of the overflow pipe and leading it into a bottle of suitable capacity. There is danger in allowing the water level in the top tank to drop too low, because vortices are likely to be created which will allow air to enter the radiator core, thereby reducing the specific heat of the mixture passing down the core, reducing the rate of heat dissipation, and eventually breaking down the system.

A valuable piece of test equipment from the radiator-manufacturer's standpoint is a glass tube which is inserted in the water line between the engine head and the radiator. Through the walls of this tube any steam bubbles in the water passing to the radiator can be observed, and if no steam enters the radiator with water at between 190 and 195 deg. F., there will be no trouble in the field due to water loss through expansion. A glass tube may also be inserted in the water line from the bottom of the radiator, to study the effectiveness of the baffles in the top tank. If these do not fulfill their purpose of evenly distributing the water over the whole width of the core, air bubbles will be noticed in the water on its way to the pump. Pump capacities and pipe sizes should be such that the depression at the pump inlet will not exceed 6 in. of mercury, as otherwise too much air is likely to enter the system and, besides, the boiling point of the water is lowered perceptibly. Top tanks should have sufficient capacity so that after the usual loss of cooling liquid due to expansion with heating, there will be enough left to completely cover the tops of the tubes. Moreover, the water entering the top tank should enter below the water level, so as to minimize agitation and the absorption of air. Excessive agitation can often be prevented by increasing the size of the inlet, thereby reducing the inlet velocity.

The introduction of grilles has relieved radiator manufacturers of the task of producing radiators that serve both their normal function and a decorative purpose. There is now no reason why radiators should be of any other than rectangular shape, that is, with straight tops and sides, and the design of their supports has been simplified.

Taking a peep into the future, the author predicted the time would come when cooling systems would operate under much higher pressure, and when fans, also, would produce higher pressures.

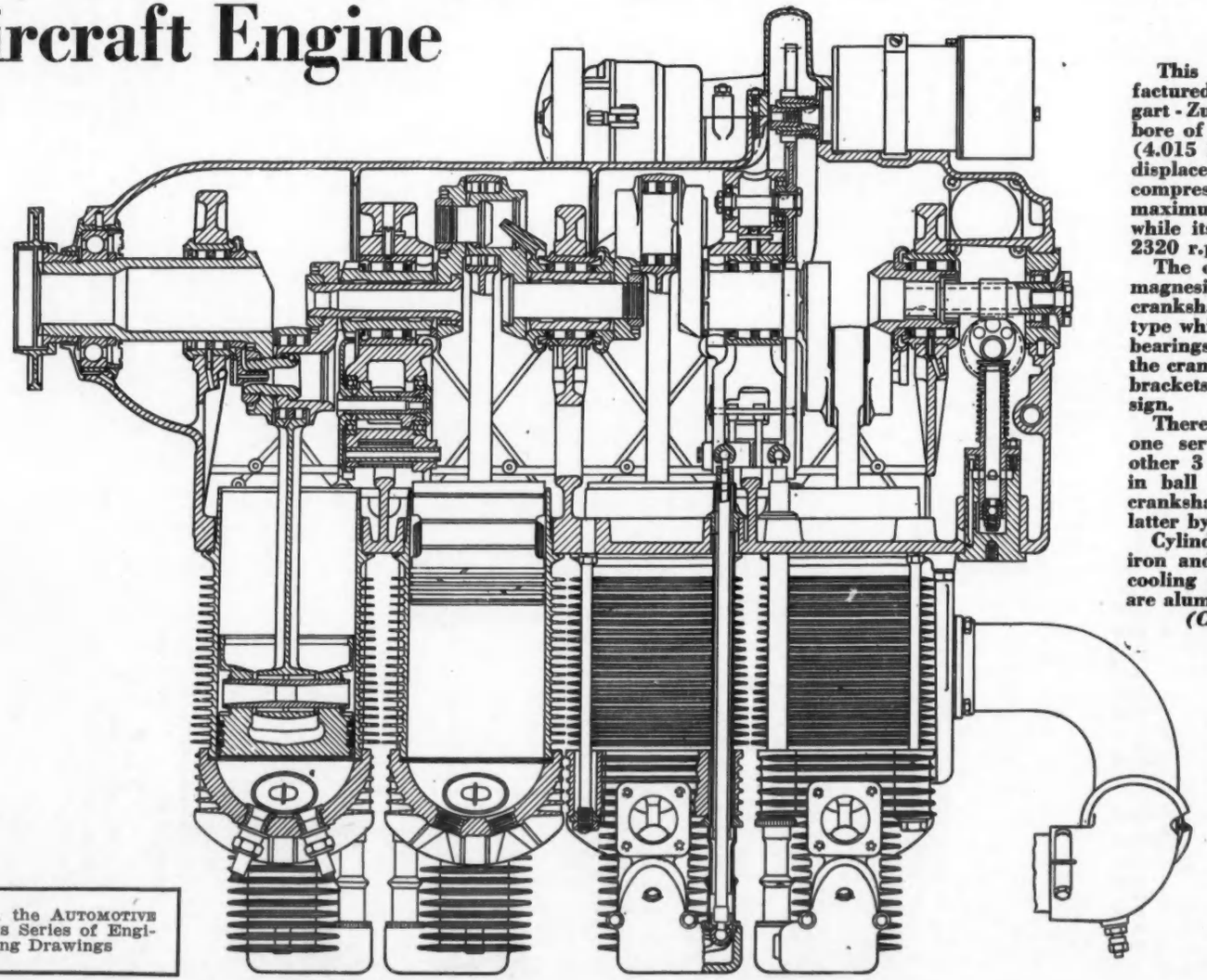
Ricardo Reviews Recent Diesel Developments

INCREASE in the tax on Diesel fuel from one penny to eight pennies per gallon in Great Britain proved a serious blow to the development of the Diesel engine for lighter commercial vehicles in that country, according to H. R. Ricardo, who read a paper on High-Speed Diesel Engines before the British Association at its annual meeting. Such development still proceeds on the Continent, however, and Mr. Ricardo mentioned that the smallest Diesel engine yet designed by his firm as a commercial product is a four-cylinder engine of 2⅞ in. bore by 4 in. stroke, developing 47 hp. at a normal governed speed of 3800 r.p.m. A large number of these 98-cu. in. engines have been built and are in service in light delivery trucks on the Continent.

Mr. Ricardo said that while his Comet engine had proved a great commercial success, there were many ways in which it could be improved upon, and the efforts of his firm during the last few years had been directed toward developing other forms of combustion chamber that would give a higher fuel economy and above all that would be able to "digest" the poorer fuels that would soon be the portion of the high-speed Diesel. Up to the present all of the larger fuel companies had been anxious to encourage the development of Diesel engines in order to absorb their surplus of heavy distillates, and to this end they had "skimmed the cream" for the nourishment of these engines. Today the balance had been almost reached and the Diesel engines of the very near future would have to be content with a fuel much inferior to that of the present time.

The recent work of the Ricardo organization therefore has been directed toward the problem of dealing with the fuels of the near future, and two new forms of combustion chamber have been evolved, one designed to use fuels of very low cetane number and to give easy starting with smooth and easy running, but about the same consumption and power output as the "Comet," and another form which, by the reduction of pumping and heat losses, gives a higher power output and a considerably lower consumption, namely, about 0.375 lb. per b.hp-hr. Meanwhile work has been continued on the sleeve-valve engine, which Mr. Ricardo said he greatly preferred for continuous hard work, on account of its almost complete freedom from wear, its low maintenance cost generally, and its very low fuel and oil consumption, which together now amounted to as little as 0.365 lb.

Hirth Four-Cylinder Inverted Air-Cooled Aircraft Engine



No. 31 in the AUTOMOTIVE INDUSTRIES Series of Engineering Drawings

This engine, which is being manufactured by Hirth Motorenbau, Stuttgart-Zuffenhausen, Germany, has a bore of 102 and a stroke of 110 mm. (4.015 by 4.331 in.) and therefore a displacement of 219 cu. in. With a compression ratio of 5.8 it develops a maximum of 80 hp. at 2400 r.p.m., while its cruising rating is 72 hp. at 2320 r.p.m.

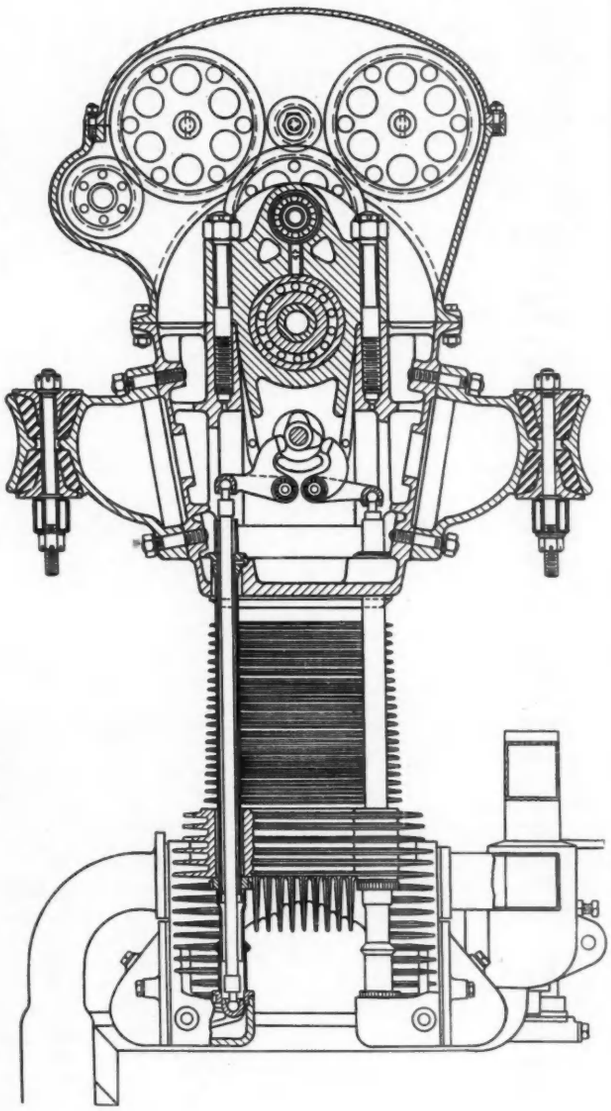
The crankcase is made up of two magnesium-alloy castings and the crankshaft is of a patented built-up type which facilitates the use of roller bearings on intermediate journals and the crankpins. The engine-supporting brackets are of rather interesting design.

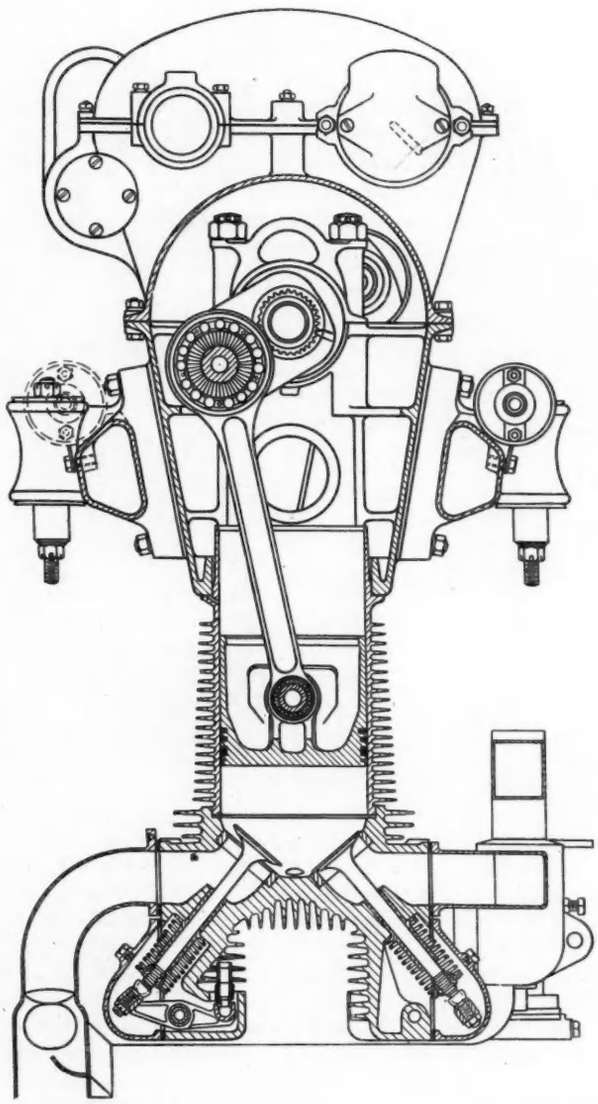
There are two separate camshafts, one serving cylinders 1 and 2, the other 3 and 4. Both are supported in ball bearings centrally below the crankshaft and are driven from the latter by spur gears.

Cylinders are made of high-test cast iron and provided with closely-spaced cooling fins, and the cylinder heads are aluminum-alloy castings. Cylinder

(Continued on next page)

Hirth Four-Cylinder Inverted Air-Cooled Aircraft Engine





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barrels and heads are held in place on the crankcase by "through" bolts. Each cylinder has one inlet and one exhaust valve, set at 40 deg. with the cylinder axis. There are two complete ignition systems, by coil and magneto. The coil spark is automatically timed while the timing lever of the magneto is interconnected with the throttle-control system. A Sum register carburetor is fitted and is supplied with warm air from a point behind the rearmost cylinder. A dry-sump lubrication system is employed, two Bosch mechanical lubricators being used, with six outlets each, and combined with a scavenging pump which forces the oil through a filter and returns it to the supply tank. The dry weight is 214 lb.

Production Lines

(Continued from page 942)

more workers in the durable goods industries alone. The real problem seems to be more work, more people employed —and not less work and shorter hours. At least that's the conclusion reached by the Public Affairs Committee and you can check their reasoning for yourself.

Electric Pump

The old familiar electric fuel pump—Autopulse — with modern refinements has made some great strides which have been drawn to our attention. While its best applications lie in the heavy duty field—on trucks, buses, and industrial equipment—we are told that a prominent auto builder takes about 2000 units a month for export shipment to hot climates. On heavy-duty jobs, it is possible to use a bank of fuel pumps, three or four to a bank, and thus produce not only a larger head but assure continuous operation even in the event of damage to one of the units.

Roller Leveling

It is quite probable that the recent experience of press shops may result in a wider use of the roller leveling machines which prepare blanks for deep drawing operations. At present such equipment is found in practically every body shop and large press shop, but not in every press shop. After the shut down of many plants due to labor difficulties, deep-drawing problems arose when the presses resumed work. Unquestionably this was due to the aging of sheets ordinarily used immediately upon receipt from the rolling mills. The installation of roller leveling machines should justify the investment in any busy press shop.—J. G.

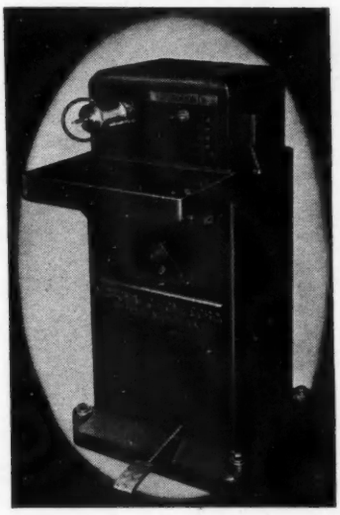
Hones Small Bores Accurately

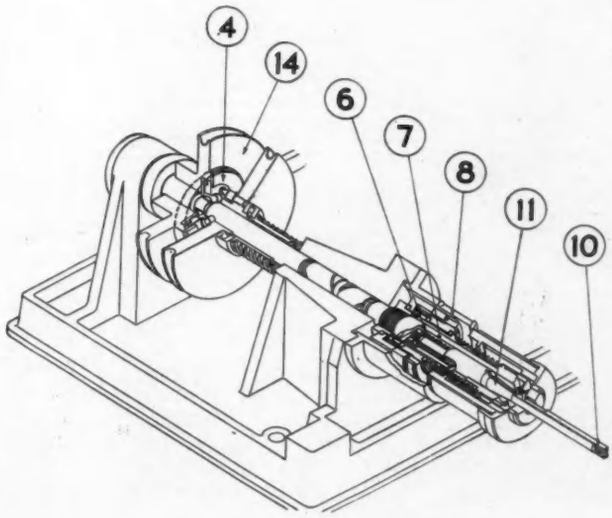
THE Microhoner, a honing machine capable of honing bores down to ¼ in. in diameter, has been announced by the Micromatic Hone Corp., Detroit, Mich. It is designed for production setups to handle a diameter range from ¼ to ⅞ in. in diameter with maximum length of 2¾ in. for the smaller diameters and up to 7½ in. in length for the larger diameters.

A manufacturer of Diesel fuel injectors is said to be using this equipment in regular production and is honing small bores with tolerance for roundness and straightness held down to twenty-five-millionths (0.000025) in.

Production with the Microhoner ranges up to 180 to 200 pieces per hour, removing 0.0007 to 0.001 in. stock from a ground hold in hard metal, and as much as 125 to 150 pieces per hour, depending upon bore diameter and length, removing from 0.001 to 0.002 in. stock from a reamed, broached, or precision bored-hole in cast iron or soft steel. Microhoned mirror finish is produced with a free cutting action in one operation from a ground surface on hardened parts or a precision-bored, reamed or broached surface on soft steel or cast iron, as well as some non-ferrous metals.

The Microhoner incorporates the unique and simplified principle of a wobble plate, indicated by No. 4 in Fig 2, to obtain a high speed, mechanical reciprocating motion, which, combined with rapid rotation, accomplishes the required spiraling or helical travel of the abrasive to produce a crosshatched honed finish. Any desired variation of crosshatch, or relative speeds of operation can be obtained by interchange of pulleys (14).





Unit time cost per piece is minimized by leaving the operator's hands free for holding the work, or for making adjustments and providing foot pedal control for starting and stopping the machine. A single foot movement by the operator engages the clutch and expands the hone to start the machine; also one foot movement stops reciprocation and rotation, while releasing the clutch and applying the brake simultaneously with the collapsing of the hone.

The same features of construction and operation incorporated in all Micromatic production honing tools are also included in the Microhoner, and comprise: Constant Pressure of Abrasive (6); Automatic Feed—Continuous feed or expansion of the stones (7); Predetermined Setting Device—Expansion of tool through calibrated adjustment which can be made while the machine is in motion (8); Low Operating Cost — Abrasive sticks are mounted on inexpensive die cast holders which are easily and quickly replaced on machine; Interchangeable Hone Bodies.

The machine is equipped with coolant tank, pump and efficient filter, with the discharge nozzle piped to the honing spindle head. It is equipped with a ¼ hp., 1725 r.p.m., 60 cycle, 3-phase electric motor.

New DEVELOPMENTS

Automotive Parts, Accessories and Production Tools

Vertical Lathe

rough turns and crowns 3½ in. by 4¼ in. pistons at rate of 400 per hr.

An 8-spindle vertical lathe, supplied by the Sundstrand Machine Tool Co., Rockford, Ill., for rough turning and crowning cast iron pistons, has a number of interesting features.

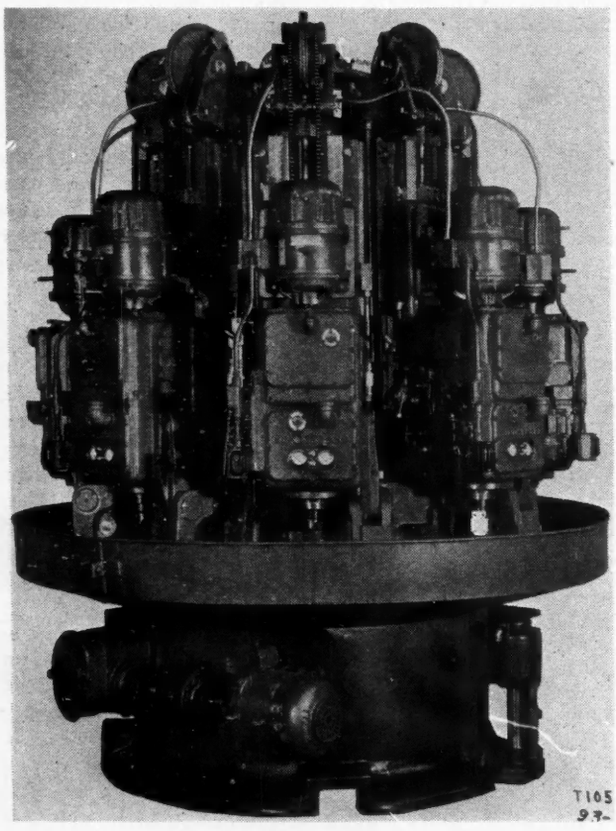
The machine has a heavy cylindrical base on which an octagonal column is mounted. An electric motor provides power for rotating the column through a speed reducer and gear box which contains pick-off gears for changing speed of column rotation.

On each face of the octagonal column is bolted a sub-base having ways on which a self-contained hydraulic unit travels vertically in an automatic cycle of approach, feed and return. On the spindle of each hydraulic unit is a push button - controlled, hydraulically - operated expanding chuck for holding the work-piece.

In normal operation, rotation of the central column is continuous. As a hydraulic unit approaches the operator, he presses a button in the control box causing the hydraulically operated chuck to contract and release the work-piece. Operator then substitutes a rough casting for the piece of work which has just been turned, and presses another button, causing the chuck to expand and grip the new work-piece.

As the central column continues to rotate it trips a limit switch and starts the automatic operating cycle of the hydraulic unit on which the work-piece has just been changed. As rotation of the column continues, the hydraulic unit feeds downward, turns, and crowns the work-piece, and automatically returns to its upper position. The column has now practically completed one revolution and the hydraulic unit is approaching the operator again for changing work-pieces. Meanwhile, work-pieces on the other seven hydraulic units have been changed successively as each one passed before the operator in its turn.

Pistons being machined on this set-up measure 3½ in. diameter by 4¼ in. long and are being turned out on the equipment described at the rate of slightly more than 400 per hr. at 85 per cent efficiency.

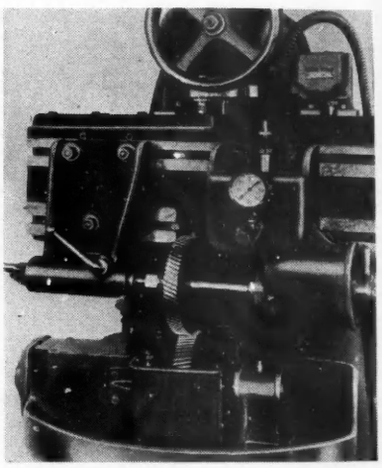


Sundstrand 8-spindle vertical lathe set-up for rough turning and crowning cast iron pistons. Pistons 3½ in. diameter by 4¼ in. long are turned out at slightly more than 400 per hr.; 85 per cent efficiency.

Gear Lapping

for correction of spiral angle, eccentricity, involute curvature and tooth spacing; machine takes 8-in. diameter gears.

A new gear lapping machine has been developed by National Broach and Machine Co., Detroit. Primary function of the machine is correction of spiral angle, eccentricity, involute curvature and tooth spacing. The crossed axes principle of lapping in which the lap gear drives the work gear is utilized in this equipment. One side of the work gear teeth is processed as the lap rotates in one direction, and the other side processed when direction of rotation is reversed.



The crossed - axes principle of lapping is used in the new National Broach gear lapping machine. Equipment has capacity for gears up to 8 in. in diameter.

The work gear spindle is carried on a cross slide which automatically reciprocates the work gear across the face of the lap. Cross slide movement is actuated and controlled hydraulically; length, speed and number of strokes may be varied at will. Any number of strokes may be made before direction of lap rotation is changed, likewise any number after change is made.

A hydraulic brake, acting in conjunction with the work gear spindle,

is used to load this spindle and provide necessary pressure between teeth of the lap and those of the gear. Pressure can be accurately regulated to suit the need of the individual part processed.

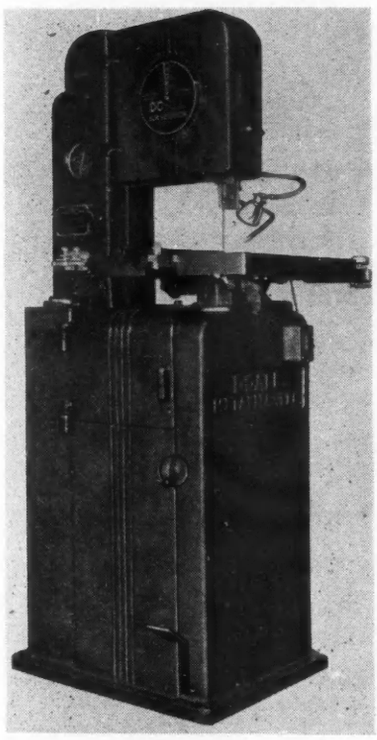
The new machine will accommodate gears up to 8 in. in diameter. Maximum lap face is 3¾ in.

Machining Operations

usually carried out by shaping, milling, lathe work or torch cutting accomplished on new contour saw at appreciable time saving.

Continental Machine Specialties, Inc., Minneapolis, has announced a new machine tool called the Metalmaster and claims that machining operations usually carried out by shaping, milling, lathe work or torch cutting are accomplished on the machine at appreciable time saving.

In shaper operations material is removed in one slab instead of being reduced to chips. Cutting is done continuously instead of with an oscillating motion. Similarly in milling, the machine does slitting and also removes slugs preparatory to milling.



The Continental Metalmaster contour saw is built in two sizes: a 14-in. throat and a 30-in. throat. Saw speed range is 50 ft. per min. to 800 ft. per min.

In lathe operations, the contour saw cuts true circles of any diameter, the diameter not being confined to swing or throat. Material is also saved because the rim is sliced off and not reduced to chips. In place of torch cutting operations, clean shapes are machined without "burning" the metal.

Feature of the Metalmaster models is the quicker joining of saw band ends which is made possible by a new butt welder. It is instantaneous and full automatic in operation. Saw ends are placed together in the welder, operator presses the switch, and a positive weld is made instantly and automatically. Another development available with the new models is closer control of a wider range of operating speeds. Patented vee-type variable speed pulleys incorporating a vee-belt transmission with interlocking variable pitch double groove sheaves have been developed. A speed change ratio of 16 to 1 is provided, giving a saw speed range from 50 ft. per min. to 800 ft. per min.

The table tilts four ways: 45 deg. forward, 10 deg. back and 10 deg. laterally. Metalmaster machines are built in two sizes: a 14 in. throat to accommodate most tool and production work and a 30 in. throat machine supplied for users requiring additional capacity.

Chilton strengthens publishing plan with 1937 no-waste advertising package

Motor World Wholesale, beginning with the issue of July, 1937, will be enlarged from pocket size to standard size, with the same 7″ x 10″ type page as Motor Age and Automobile Trade Journal.

Its circulation will be concentrated on the leading jobbers who do 85% of the dollar volume in the automotive wholesale field. Advertising space in Motor World Wholesale will be a plus service to advertisers in Motor Age or Automobile Trade Journal. A page in either of these publications will carry with it the privilege of a page without cost in Motor World Wholesale, and this same privilege goes with fractional pages, too.

This automotive advertising package, unmatched and unmatchable, is by all odds the best buy ever offered in this field.

There will be no immediate increase in the advertising rates of Motor Age or Automobile Trade Journal. Contracts at the present rates ($160 per page on a 12-time basis) will be accepted until further notice.

Ask for complete details.

CHILTON COMPANY

Chestnut and 56th Sts. Philadelphia Pa.

REPLACEABLE *for Genuine Economy*

Automobiles, buses and trucks regularly give thousands and thousands of miles of service, never needing a new piston, a new gasket, a new tube, or even a new tire valve part. But, because wherever there is friction, or pressure there is wear; because there are always exceptional circumstances, all the parts of an automobile are made replaceable.

The very success of the automobile has been due to this replaceability that has made prompt economical service possible throughout the country.

In manufacture, assembly, or in an emergency on the highway, the Schrader type of tire valve with its replaceable parts, is the most economical and easiest to service. Doubly-sealed Schrader Valves give the extra protection that modern driving conditions require.

Replacement of the valve core and cap is, in most instances, all that is necessary when a standard tire valve requires service. Schrader Valve Cores and Caps will service any valve regardless of the size of tire. A supply of these important parts requires but a minimum of investment by the more than 100,000 dealers who handle them.

A. Schrader's Son Brooklyn, New York
Division of Scovill Manufacturing Company, Incorporated

REPLACEABLE
minimizes service work

DOUBLY-SEALED
2-to-1 safety factor

Schrader
TIRE VALVES
with Replaceable Parts

◆ BUYERS' GUIDE ◆

Automotive Products and Factory Equipment Manufactured by Advertisers in This Issue

See Alphabetical List of Advertisers on pages 42-43

This Advertisers' Index is published as a convenience, and not as part of the advertising contract. Every care will be taken to index correctly. No allowance will be made for errors or failure to insert.

Alloys
Non-ferrous
Dow Chemical Co. (Magnesium)

Arms & Knuckles, Steering
Atlas Drop Forge Co.

Axles
Atlas Drop Forge Co.
Union Drawn Steel Co. (Cold Drawn)

Belting, (Metal Conveyor, High & Low Temperature)
Wickwire Spencer Steel Co.

Blanks
Forged
Atlas Drop Forge Co.

Boring Machines
Baker Brothers, Inc.
Greenlee Brothers & Co.

Brake Strand
Wickwire Spencer Steel Co.

Brake Testers
Bendix Products Corp.

Brakes
Electric
Warner Electric Brake Mfg. Co.
Hydraulic
Bendix Products Corp.
Mechanical
Bendix Products Corp.
Power
Bendix Products Corp.

Camshafts
Atlas Drop Forge Co.

Carburetors
Bendix Products Corp.

Channels for Glass
Felt
American Felt Co.

Cleaners
Metal
American Chemical Paint Co. (Rust Preventive)

Clutches
Borg & Beck Co. (Division of Borg-Warner Corp.)

Connecting Rods
Atlas Drop Forge Co.

Controls
Choke (Automatic)
Bendix Products Corp.
Clutch (Automatic)
Bendix Products Corp.

Crankshafts
Union Drawn Steel Co.
Wyman-Gordon Co.

Cutters
Baker Brothers, Inc. (Keyseaters)

Discs, Clutch
Borg & Beck Co. (Division of Borg-Warner Corp.)

Drilling Machines
Baker Brothers, Inc.
Greenlee Brothers & Co.

Drives, Starter
Bendix Products Corp.

Drop Forgings
Atlas Drop Forge Co.
Wyman-Gordon Co.

Felt
American Felt Co.

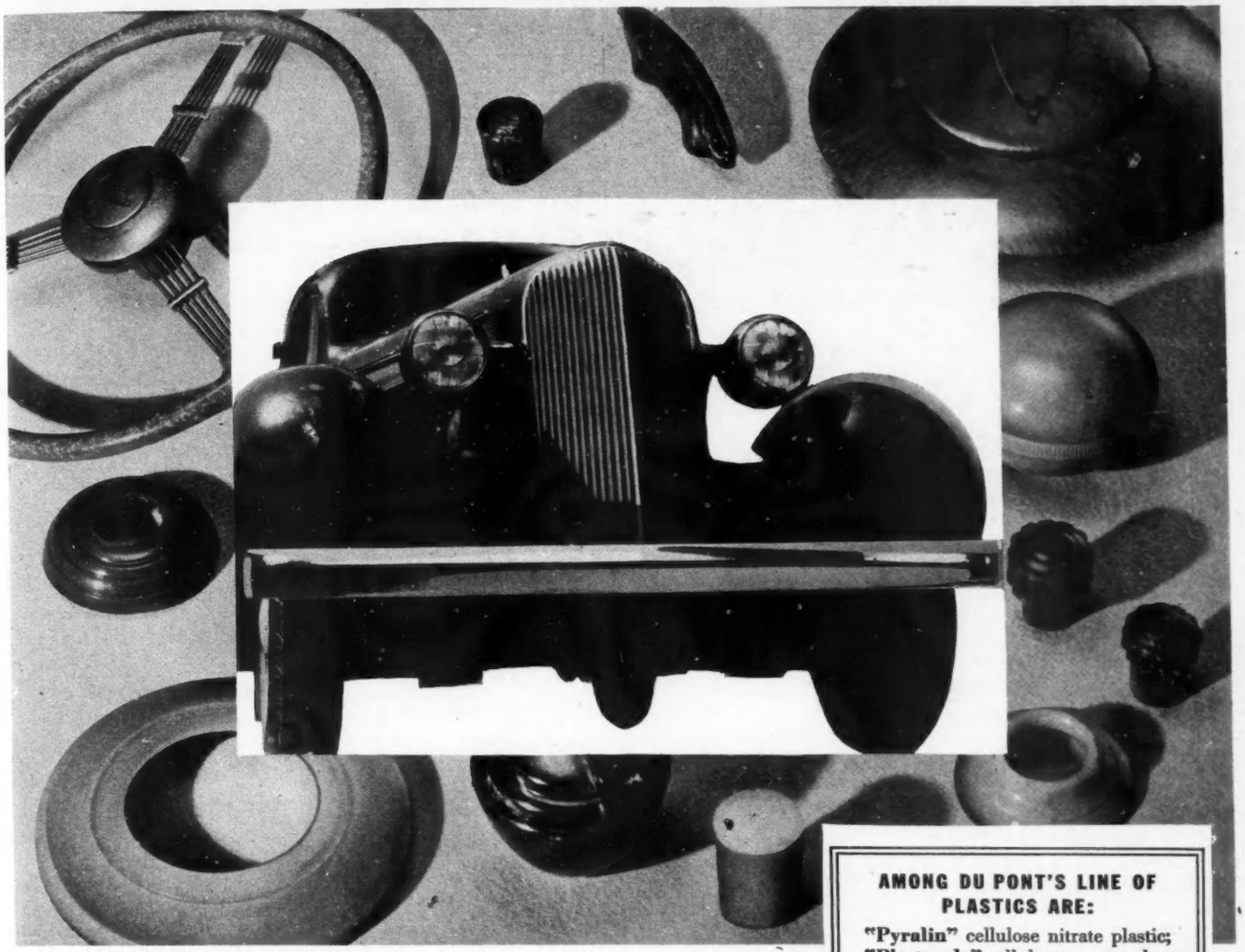
Fenders
Motors Metal Mfg. Co.

Filters, Gasoline
Zenith Carburetor Co., Subsidiary of Bendix Aviation Corp.

(Turn to page 40, please)

A new, colorful plastic for **1938** *Automotive parts*

. . . Du Pont's "Plastacele"* Molding Powder



TWENTY-SIX individual parts that go to make up the attractive inside trim in each of the two most popular 1937 cars are molded from cellulose acetate powder.

Lovely and unusual color effects can be obtained with "Plastacele" Molding Powder. It is supplied in varied granulations, in translucent, transparent, opaque and solid colors, as well as mottled and pearl effects. Products made of "Plastacele" Molding Powder are pliable, light weight, tough, of high impact and tensile strength.

"Plastacele" Molding Powder is particularly suitable for injection molding and can be supplied in varied degrees of hardness to meet exacting needs. Metal cores can be covered with this plastic, eliminating expensive metal finishing. This process adds the beauty and strength of "Plastacele" to the rigidity of metal.

Du Pont's leadership in chemistry and chemical research has made possible the development of *six* different plastics to serve practically every purpose. And research is developing more to meet new needs as they come along.

Among these six plastics, there is likely to be one which fits your requirements exactly. We will gladly tell you how du Pont Plastics can be used in your business, or send you complete information about them. If you are not familiar with molding powder, consult your molder about "Plastacele" Molding Powder. E. I. du Pont de Nemours & Co., Inc., Plastics Department—Industrial Division, Arlington, N. J.

•

**"Plastacele" is du Pont's registered trademark for its cellulose acetate molding powder.*

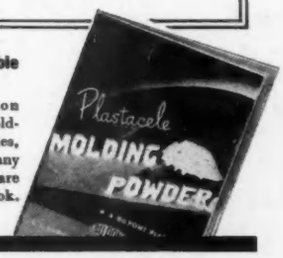
AMONG DU PONT'S LINE OF PLASTICS ARE:

"Pyralin" cellulose nitrate plastic; **"Plastacele"** cellulose acetate plastic; **"Phenalin"** cast phenolic resin; **"Lucite"** methyl methacrylate resin, formerly sold under the trade-mark "Pontalite."

These four plastics are available in sheets, rods, and tubes. For injection and pressure molding, there are: **"Plastacele"** cellulose acetate molding powder; and **"Lucite"** methyl methacrylate molding powder.

Send for this valuable free book

Complete information about "Plastacele" Molding Powder, its qualities, methods of use, and many varied applications are contained in this book.



DU PONT

PLASTICS

BUYERS' GUIDE (*Continued from page 38*)

Gages, Tire
A. Schrader's Son, Division of Scovill Mfg. Co., Inc.

Gaskets
Felt
American Felt Co.

Grease Seals & Retainers
Chicago Rawhide Mfg. Co.

Heat Treating
Barnes Co., Wallace, Div. of Associated Spring Corp.
Barnes-Gibson-Raymond, Div. of Associated Spring Corp.
Gibson Co., Wm. D., Div. of Associated Spring Corp.

Hoods
Motors Metal Mfg. Co.

Hotels
Melbourne Hotel
Stuyvesant Hotel
Wellington Hotel

Keyseaters
Baker Brothers, Inc.

Lathes
Automatic Chucking
Potter & Johnston Machine Co.
Turret
Potter & Johnston Machine Co.

Leather Goods, Mechanical
Chicago Rawhide Mfg. Co.

Leather Parts, Boots, Straps
Chicago Rawhide Mfg. Co.

Milling Machines
Potter & Johnston Machine Co.

Molding Materials (Powder)
E. I. duPont de Nemours & Co., Inc., Plastics Dept., Industrial Division

Oils
Rust Preventing
American Chemical Paint Co.

Packings
Leather
Chicago Rawhide Mfg. Co.

Pads
Felt
American Felt Co.

Paint Pretreatments
American Chemical Paint Co.

Paints, Heat Resisting
American Chemical Paint Co.

Perforated Metal
Wickwire Spencer Steel Co.

Plastic Materials
Sheets, Rods & Tubes
E. I. duPont de Nemours & Co., Inc., Plastics Dept., Industrial Division

Radio Remote Control
S. S. White Dental Mfg. Co.

Radiator Shells
Motors Metal Mfg. Co.

Running Boards
Metal
Motors Metal Mfg. Co.

Rust Proofing
American Chemical Paint Co.

Screens, Woven Wire
Wickwire Spencer Steel Co.

Screw Machines
Greenlee Brothers & Co.
Potter & Johnston Machine Co.

Screw Machine Products
Barnes Co., Wallace, Div. of Associated Spring Corp.

Seals, Oil & Grease
Chicago Rawhide Mfg. Co.

Shafting
Bliss & Laughlin, Inc.
National Tube Co., U. S. Steel Corp. Subsidiary
Union Drawn Steel Co.

Shafts & Casings, Flexible (Radio)
S. S. White Dental Mfg. Co.

BUYERS' GUIDE—Continued

Shafts, Axle, Propeller and Transmission

Mechanics Universal Joint (Division Borg-Warner Corp.)

Shock Absorbers

Delco Products Division General Motors Corp.

Soldering Flux

(Self-Cleaning)

American Chemical Paint Co.

Special Machinery

Baker Bros., Inc.

Greenlee Brothers & Co.

Springs

Extension, Compression, Torsion or Flat

Barnes Co., Wallace, Div. of Associated Spring Corp.

Barnes-Gibson-Raymond, Div. of Associated Spring Corp.

Cook Plant of Barnes-Gibson-Raymond, Div. of Associated Spring Corp.

Gibson Co., Wm. D., Div. of Associated Spring Corp.

Raymond Mfg. Co., Div. of Associated Spring Corp.

Wickwire Spencer Steel Co.

Stampings

Lansing Stamping Co.

Stampings & Drawings, Metal

Barnes-Gibson-Raymond, Div. of Associated Spring Corp.

Barnes Co., Wallace, Div. of Associated Spring Corp.

Cook Plant of Barnes-Gibson-Raymond, Div. of Associated Spring Corp.

Gibson Co., Wm. D., Div. of Associated Spring Corp.

Motors Metal Mfg. Co.

Raymond Mfg. Co., Div. of Associated Spring Corp.

Worcester Stamped Metal Co.

Starter Switches, Automatic

Bendix Products Corp.

Steel

Alloys

Bliss & Laughlin, Inc.

Union Drawn Steel Co.

Bars

Bliss & Laughlin, Inc.

Union Drawn Steel Co.

Carbon

Bliss & Laughlin, Inc.

Union Drawn Steel Co.

Cold Drawn

Bliss & Laughlin, Inc.

Electric Furnace

Bliss & Laughlin, Inc.

Union Drawn Steel Co.

Sheets

Columbia Steel Co., U. S. Steel Corp. Subsidiary

Spring

Barnes Co., Wallace, Div. of Associated Spring Corp.

Barnes-Gibson-Raymond, Div. of Associated Spring Corp.

Carnegie-Illinois Steel Co., U. S. Steel Corp. Subsidiary

Gibson Co., Wm. D., Div. of Associated Spring Corp.

Union Drawn Steel Co.

Stainless

Columbia Steel Co., U. S. Steel Corp. Subsidiary

Union Drawn Steel Co.

Vanadium

Union Drawn Steel Co.

Steering Gears

Ross Gear & Tool Co.

Tapping Machines

Baker Brothers, Inc.

Greenlee Brothers & Co.

Tubing, Stainless Steel (Seamless)

National Tube Co., U. S. Steel Corp. Subsidiary

Turret Machines, Automatic

Potter & Johnston Machine Co.

Universal Joints

Mechanics Universal Joint Co., Div. Borg-Warner Corp.

Valves, Tire (Metal)

A. Schrader's Son, Division of Scovill Mfg. Co., Inc.

Washers

Felt

American Felt Co.

Lock

Thompson-Bremer & Co.

Wicks

Felt

American Felt Co.

Wire

Flat, Round, Square or Special Shapes

Barnes Co., Wallace, Div. of Associated Spring Corp.

Wickwire Spencer Steel Co.

Spring

Barnes Co., Wallace, Div. of Associated Spring Corp.

Wire, Piano & Music

Wickwire Spencer Steel Co.

Wire Rope

Wickwire Spencer Steel Co.

Index to Advertisers

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Index to Advertisers

This Advertisers' Index is published as a convenience, and not as part of the advertising contract. Every care will be taken to index correctly. No allowance will be made for errors or failure to insert.

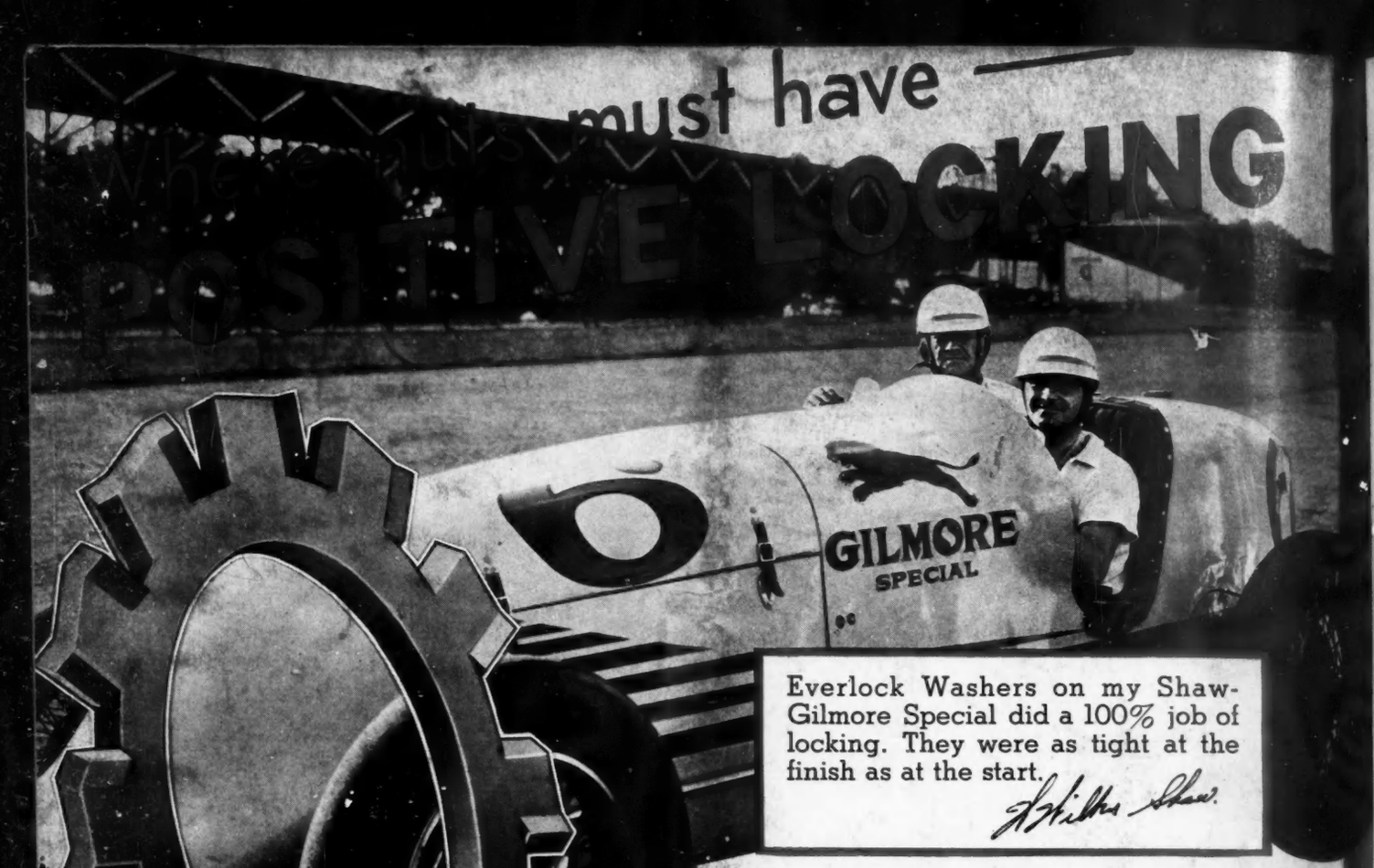
SMOOTH SAILING AHEAD!

No matter how smooth the modern highway looks, there are still dips, bumps and expansion strips which transmit shock to the wheels. However, this shock does not reach the passengers when the car is equipped with Patented Delco Shock Absorbers—there's smooth sailing ahead on all roads. Delco Hydraulic Shock Absorbers are designed to meet the requirements of every type of springing and assembly: Single Acting, Double Acting, Direct Acting, Inertia Control, and special applications for cars with Individual Wheel Suspension. Delco Products Division, General Motors Corporation, Dayton, Ohio.

DELCO

HYDRAULIC SHOCK ABSORBERS

must have POSITIVE LOCKING



Everlock Washers on my Shaw-Gilmore Special did a 100% job of locking. They were as tight at the finish as at the start.

H. Wilbur Shaw

U. S. Patent No. 1775705

ALL 33 SPEEDWAY ENTRIES USED EVERLOCK WASHERS

Five hundred gruelling miles—a life time of violent vibration jammed into four and one half hours—*what a test for lock washers!*

In 1937, as in 1936, every entry in the Indianapolis Speedway Race used Everlock Washers! Both years after the race, inspections showed 100% Everlock performance.

Here's proof aplenty that Everlock Washers give the utmost protection against the hazards of loosened nuts and screws.

Write for FREE SAMPLES. See for yourself how Everlock Positive Locking and Powerful Spring Tension defy vibration!

Thompson-Bremer & Co.
1640-F W. Hubbard St. - - - CHICAGO

Congratulations! Everlock Washers on my Hamilton Harris No. 8 Special held perfectly against the terrible strain and vibration of 500 miles at top speed. Not a loose unit on entire car after grind.

Ralph Hepburn

Many thanks to your Everlock Washers. They did a marvelous job in keeping the nuts and screws tight on my car.

Ted Horn

Everlock DUAL ACTION LOCK WASHERS